JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

APRIL, 1852.

CIVIL ENGINEERING.

Philadelphia and Reading Railroad.

Few persons are aware of the magnitude and importance of this work. The following extracts from their published report for the past year, will present at a glance many items of importance.

Travel equal to		57,593 through passengers.	
Freight of merchandise,		63,807 tons.	
" coal,		1,650,270 "	
Wood consumed on road,		61,222 cords.	
Coal " anthracite,		5,640 tons.	
" " bituminous,		4,023 "	
Cost of tallow, lard, grease, and cotton waste,			$10,292·75
Wages of engineers, firemen, conductors, &c., on road,			132,068·02
" workmen in workshops,			175,820·59
Cost of wrought iron and steel used in workshops,			20,652·22
" cast iron	"	"	4,217·03
" copper, tin, spelter, lead	"	"	5,328·76
" timber and lumber	"	"	12,116·70
" anthracite coal	"	"	4,978·54
" bituminous "	"	"	3,610·95
" wheels, axles, and tires	"	"	26,354·93
" hardware, paints, oils, leather, stone, and lime,			13,638·92

Breakage of Coal Cars.

In 1848	1	car	for	every	1485	tons	of coal carried.
1849	1	"	"		2282	"	" "
1850	1	"	"		2490	"	" "
1851	1	"	"		3114	"	" "

Rails removed from track.

In 1848	1	bar	for	every	266	tons	of coal carried.
1849	1	"	"		314	"	" "
1850	1	"	"		332	"	" "
1851	1	"	"		279	"	" "

Wear of different kinds of rails per cent. per annum.

	Average of 1848-9.	1850.	1851.	
Old English, 60 lbs. per yard,	6·2	8·3	9·4	heavy
" 52 " "	1·4	1·2	2·6	track.
" 45 " "	1·3	1·4	1·9	light
Several superior patterns called Erie,		14·8	17·8	track.
American Phœnixville, 60 lb. pr. yd.	0·7	4·8	6·3	heavy
" Danville, " "			1·7	track.

Employed on the Road.

59 first class locomotives.
20 second "
7 third "
3 fourth "

Total, 89

1 8-wheel iron coal car.
2982 4-wheel " "
1596 4-wheel wooden coal cars.

Total, 4579

21 8-wheel passenger cars.
5 8-wheel baggage "
2 8-wheel mail and express cars.

STATEMENT E.—*Table of Names, Weights, Makers, Condition, and present Duty of all Locomotive Engines owned by the Philadelphia and Reading Railroad Company, November 30, 1851.*

Names.	Class.	Weight.	Maker.	When first ran.	Miles Ran.		Condition and Duty.
					Past Year.	Total to Date.	
Atlas, . .	1st	27·0	Baldwin, Philadelphia.	April, 1846	16,206	84,325	At work, Falls Grade.
Hercules, .	"	27·0	do do	" "	16,107	80,486	do do
Texas, .	"	22·5	do do	" "	20,892	103,914	do in Coal Trade.
Alabama, .	"	22·5	do do	" "	20,984	109,990	In shop, under repair.
Kentucky, .	"	22·5	do do	" "	22,883	94,631	At work, in Coal Trade.
Indiana, . .	"	21·9	do do	" "	15,083	104,733	do do
Princeton, .	"	22·5	do do	May, "	25,031	107,068	do do
Montezuma, .	"	22·5	do do	July, "	20,945	106,518	do do
Amazon, .	"	22·5	do do	May, "	22,758	104,265	do do
Warrior, . .	"	22·5	do do	" "	19,853	102,836	In shop, under repair.
Florida, .	"	22·5	do do	July, "	21,795	103,680	At work, in Coal Trade.
Washington, .	"	22·5	do do	June, "	18,951	94,851	In shop, under repair.
Empire, .	"	22·5	do do	May, "	18,310	111,027	At work, in Coal Trade.
Pocahontas, .	"	22·5	do do	June, "	15,203	103,394	In shop, under repair.
Yorktown, .	"	22·5	do do	" "	21,604	109,135	At work, in Coal Trade.
Rio Grande, .	"	20·1	do do	July, "	21,172	100,792	In shop, under repair.
United States,	"	18·6	do do	" 1844	14,316	129,462	At work, in Coal Trade.
New England,	"	19·7	do do	" "	21,300	134,124	do do
New York, .	"	19·1	do do	August, "	20,852	137,587	do do
Ontario, . .	"	19·1	do do	" "	19,101	137,762	do do
Virginia, .	"	19·1	do do	September "	17,264	131,148	do do
Hudson, . .	"	19·6	do do	October, "	20,052	112,617	In shop, under repair.
Niagara, .	"	19·6	do do	April, 1845	19,016	120,764	At work, in Coal Trade.
Pacific, . .	"	19·5	do do	" "	20,960	116,180	do do
Independence,	"	19·5	do do	May, "	20,931	126,924	do do
Oregon, . .	"	19·5	do do	" "	21,271	115,816	do do
St. Lawrence,	"	19·5	do do	June, "	21,914	117,125	do do
Constitution, .	"	19·5	do do	" "	21,103	98,615	do do
Champlain, .	"	20·1	do do	September "	21,460	112,781	do do

STATEMENT E.—(Continued.

Names.	Class.	Weight.	Maker.	When first ran.	Miles Ran.		Condition and Duty.
					Past Year.	Total to Date.	
Dauphin, .	1st	23·7	Baldwin, Philadelphia.	October, 1850	22,212	25,084	At work, in Coal Trade.
Baltic, .	"	22·9	do do	" "	23,735	27,352	do do
Perry, . .	"	23·8	do do	" "	22,942	27,308	do do
Seminole, .	2d	13·1	do do	Febru'y, 1840	14,051	160,005	do Wood Train.
Baltimore, .	1st	28·0	Ross Winans, Baltimore.	June, 1847	12,438	71,525	At work, in Coal Trade.
Maryland, .	"	28·0	do do	September, "	10,105	56,862	do do
Delaware, .	"	28·0	do do	" "	16,826	68,560	do do
Ohio, . .	"	28·0	do do	" "	13,454	69,609	In shop, under repair.
Patapsco, .	"	24·6	do do	October, 1850	19,156	23,769	At work, in Coal Trade.
Minesota, .	"	22·5	do do	November, "	16,670	18,077	In shop, under repair.
Georgia, .	"	24·1	do do	October, "	23,643	26,713	At work, in Coal Trade.
Louisiana, .	"	23·9	do do	November, "	21,870	23,985	do do
Mohawk, .	1st	19·4	Norris, Schenectady.	October, "	22,439	24,922	At work, Passenger Train.
Genesee, .	"	19·5	do do	" "	18,472	21,151	do do
Allegheny, .	1st	23·9	Reading Railroad Company.	Novem'r, 1851	381	381	At work, in Coal Trade.
Wyoming, .	"	19·6	do do	Febru'y, 1847	14,115	78,491	do Lateral Railroads.
Palo Alto, .	"	20·8	do do	May, "	18,474	80,802	do do
Monterey, .	"	19·9	do do	June, "	18,352	75,980	do do
Saratoga, .	"	19·2	Rebuilt by do	" 1842	12,769	114,500	In order, ready for use.
Mahanoy, .	"	20·2	do do	May, "	13,291	125,862	do do
Atlantic, .	"	20·1	do do	August, 1844	19,925	113,012	At work, in Coal Trade.
Philadelphia, .	"	20·2	do do	Septem'r, 1851	2,901	2,901	do do
California, .	"	21·5	do do	May, 1848	20,916	63,500	do do
Chesapeake, .	"	20·0	do do	March, 1847	10,971	66,814	do Philadelphia Branch.
Monocacy, .	2d	16·4	do do	" 1842	17,091	173,814	In order, ready for use.
Reading, .	"	16·2	do do	October, "	10,041	140,577	At work, Roadway Department.
Schuylkill, .	"	14·7	do do	July, 1843	10,906	88,218	do Richmond Wharves.
Osceola, . .	"	14·8	do do	August, "	11,152	79,592	do do
Huron, .	"	14·8	do do	" "	10,604	90,920	do do
Erie, . .	"	14·8	do do	" "	10,609	91,509	do do
Ontalaunee, .	"	14·6	do do	July, "	10,877	89,933	do do

STATEMENT E.—(Continued.)

STATEMENT E.—(Continued.)

Names.	Class.	Weight.	Maker.	When first ran.	Miles Ran. Past Year.	Miles Ran. Total to Date.	Condition and Duty.
Buena Vista,	2d	16·9	Reading Railroad Company.	April, 1848	17,478	59,482	In order, ready for use.
Vera Cruz,	"	16·7	do do	" "	19,908	83,202	At work, Passenger Train.
Cerro Gordo,	"	16·8	do do	July, "	23,330	76,644	do do
Gazelle,	3d	11·0	Rebuilt by do	March, 1841	14,328	190,436	do Roadway Department.
Atalanta,	"	10·3	do do	April, "	22,170	180,732	In shop, under repair.
Antelope,	"	9·3	do do	June, 1838	8,443	122,030	At work, Valley Passenger Train
Stag,	4th	14·6	Reading do	Febru'y 1851	8,901	8,901	do Roadway Department.
Ariel,	"	4·3	do do	" 1846	11,093	76,675	In shop, under repair.
Witch,	"	5·2	do do	October, 1847	14,557	49,085	At work, Lateral Railroads.
Maine,	1st	20·0	Boston Locomotive Works.	July, 1849	20,865	48,835	At work, Freight Train.
Massachusetts,	"	20·1	do do	" "	16,158	45,381	In shop, under repair.
Vermont,	"	20·2	do do	" "	25,283	52,515	At work, Freight Train.
Carolina,	1st	18·8	Newcastle Company.	April, 1846	12,113	74,548	do Lateral Railroads.
Missouri,	"	18·8	do do	August, "	17,536	83,111	do do
Columbus,	"	18·5	do do	April, 1844	8,904	80,775	In shop, under repair.
Tuscarora,	2d	11·8	do do	Novem'r, 1842	8,375	87,080	At work, Lateral Railroads.
Pennsylvania,	"	11·4	do do	April, 1843	10,248	86,320	do do
Manatawny,	2d	13·8	Norris, Philadelphia.	October, 1842	11,508	159,388	At work, Extra Train.
America,	"	13·4	do do	" "	11,478	140,131	do Wood Train.
Conestoga,	2d	11·8	Locks and Canals Company.	May, 1843	6,865	85,995	At work, Lateral Railroads.
Shamokin,	"	11·8	do do	July, "	5,940	82,987	do do
Potomac,	"	11·8	do do	August, "	9,056	103,088	do do
Roanoke,	"	11·8	do do	Septem'r, "	6,872	78,164	do do
Engineer,	3d	8·8	Braithwaite & Co., London.	May, 1838	12,959	141,100	At work, Roadway Department.
Rocket,	"	8·4	do do	" "	12,484	169,957	do do
Planet,	"	8·4	do do	August, "	12,454	153,554	do do
Hecla,	"	8·4	do do	July, 1840	1,627	135,351	do Lateral Railroads.
Gowan and Marx,	2d	11·0	Eastwick & Harrison, Philadelphia.	January, "	6,025	101,542	At work, Reading Depot.
Cambridge,	1st	25·5	Davenport, Bridges & Kirk, Cambridgeport.	June, 1850	16,978	27,010	do in Coal Trade.

CONDENSED TABLE, *Showing Condition and Employment of all Engines owned by the Philadelphia and Reading Railroad Company.*

How Employed.	1st. Class.	2d. Class.	3d. Class.	4th. Class.	Total.
In daily use, in good order, on Reading or Lateral Roads,	47	18	6	2	73
In workshops, under Repair,	10	0	1	1	12
In good order, ready for use,	2	2	0	0	4
Totals,	59	20	7	3	89

STATEMENT F.—*Work and Repairs of all Locomotive Engines owned by the Philadelphia and Reading Railroad Company, for the year ending November* 30, 1851.

MILES RAN.

How employed.	Classes.				Total.
	1st.	2d.	3d.	4th.	
Reading Railroad Transportation Department. . . .	990,915	206,660	10,901	21,075	1,229,551
Reading Railroad Roadway Department, ...	13,170		14,597	7,194	34,961
Reading Railroad Renewal Department, ...					
September Freshet, and re-building State Road, . . .	485		36,023		36,508
Total Reading Railroad, . .	1,004,570	206,660	61,521	28,269	1,301,020
On Lateral Roads in Coal Region,	87,757	43,769	22,944	6,282	160,752
Total, ...	1,092,327	250,429	84,465	34,551	1,461,772

Total number of tons hauled 1 mile, exclusive of engine and tender,			366,157,599
Average weight of loaded coal trains down,	"	"	622
" " empty coal trains up,	"	"	208
" " passenger train,	"	"	54

All tons of 2,000 lbs.

COST OF REPAIRS OF ENGINES.

Wages of all mechanics, ...	$61,715 42
Materials, iron, steel, brass, &c., ...	25,173 40
Superintendence, tools, paints, &c., ...	10,861 10
	$97,749 92
Total number of miles ran by all engines owned and used by Company from May, 1838, to November 30, 1851,	9,371,217
Total number of tons hauled between same dates,	2,140,289,471

STATEMENT G.—*Cost of Repairs and Renewals of Coal, Freight, and Passenger Cars on the Philadelphia and Reading Railroad, for the year ending November* 30, 1851.

COAL, FREIGHT, AND WOOD CARS.

Wages of all mechanics, ...	$79,681 16
Timber, iron, steel, and all metals, ...	60,110 56
Superintendence, tools, paints, oils, &c., . . .	13,979 17
Total,	$153,770 89

COST OF REPAIRS OF PASSENGER CARS.

Wages of all mechanics,	$3,978 64
Iron, steel, timber, &c.,	3,528 30
Superintendence, tools, paints, varnish, &c.,	938 37
Total,	$8,445 31

STATEMENT G.—*Cost of Repairs and Renewals of Coal, Freight, and Passenger Cars on the Philadelphia and Reading Railroad, for the year ending November* 30, 1851.

COAL, FREIGHT, AND WOOD CARS.

Wages of all mechanics,	$79,681 16
Timber, iron, steel, and all metals,	60,110 56
Superintendence, tools, paints, oils, &c.,	13,979 17
Total,	$153,770 89

COST OF REPAIRS OF PASSENGER CARS.

Wages of all mechanics,	$3,978 64
Iron, steel, timber, &c.,	3,528 30
Superintendence, tools, paints, varnish, &c.,	938 37
Total,	$8,445 31

STATEMENT H.—*Items of Cost, in detail, of Hauling Coal on the Philadelphia and Reading Railroad, for the year ending November* 30, 1851.

Per round trip of 190 miles, from Coal Region to Tide Water and back, with empty cars, transporting an average load of 368 tons of Coal each Train.

Items of Cost.	No.	Description.	Average Rate.	Amount.
Wages of Engineer,	2	Days.	2·90	5 80
" Fireman,	2	"	1·59	3 18
" Conductor,	2	"	1·50	3 00
" Brakeman,	6	"	1·18	7 08
Wood for Fuel, including Firing up,	11·87	Cords.	4.41	52 35
Oil for Engine and Tender, including Lamps,	2·36	Gallons.	·90	2 12
Oil and Tallow for Cars,	368	Tons.	·01¼	4 91
Repairs of Engine and Tender,	190	Miles.	8·53	16 20
" Coal Cars,	368	Tons.	8·4	30 91
Supplying water,	12	M. Gallons.	·06	72
Assistant Engines at Falls Grade	368	Tons.	1·34	4 93
Car Couplers and Greasers, Time-keepers, Dispatchers, and Turning Crews,				
Allowance for Engines laying over, Assistant Engines in snow storms, &c., and all other contingent expenses,	368	"	1·02	3 75
	368	"	1·87	6 88
Equal to 38·54 cents per Ton.				$141 83

STATEMENT K.—*Items of Cost, in detail, of running Passenger Trains on the Philadelphia and Reading Railroad, for the year ending November* 30, 1851.

PER DAILY TRIP OF 92 MILES.

Items of Cost.	No.	Description.	Average Rate.	Amount.
Wages of Engineer,	1	Day.		2 25
" Fireman,	1	"		1 40
" Conductor,	1	"		1 81
" Baggage Master,	1	"		1 12
" Brakeman,	1	"		1 10
Wood for Fuel, including firing up,	2·6	Cords.	4·46	11 59
Water used,	3	M. Gallons.	·06	18
Oil for Engine and Tender,	·94	Gallons.	·95	89
Oil and Grease for Cars,				59
Repairs of Engine,	92	Miles.	·06	5 52
" and Refitting Cars,				8 04
Hands at Depots, Extra Engines, &c.,				2 62
Sundries for trains,				1 23
Equal to, at 54·8, through Passengers per Train, 69·9 cents per Passenger.				$38 34

STATEMENT L.—*Items of Cost, in detail, of running Freight Trains on the Philadelphia and Reading Railroad, for the Year ending November* 30, 1851.

Items of Cost.	No.	Description.	Average Rate.	Amount.
Wages of Engineer,	1	Day.		2 87
" Fireman,	1	"		1 44
" Conductor,	1	"		1 54
" Brakemen,	3	"	1·21	3 64
Wood for fuel, including Firing up,	4·25	Cords	4·49	19 06
Oil and Tallow, for Engine and Tender,				92
Oil and Grease for Cars,	102·6	Tons.	0·12	1 23
Repairs of Engine and Tender,	92	Miles.	5·42	4 99
" Cars,	102·6	Tons.	16·48	16 91
Depot Hands, and other Depot expenses,				16 08
Water used,	4	M. Gallons.	0·06	25
Renewals of Sundry Articles, Goods damaged, &c.	102·6	Tons.	0·21	2 16
Equal to 69·2 cents per Ton.				$71 09

STATEMENT N.—*Points of Supply, and Distribution of Coal, on the Philadelphia and Reading Railroad, for the Year ending November* 30, 1851.

Amount of Coal received from various Lateral Railroads in Coal Region.

Mount Carbon and Port Carbon Railroad, at Port Carbon, from Valley and Mill Creek Railroads,	500,365
Mount Carbon Railroad at Mount Carbon,	176,512
Mine Hill and Schuylkill Haven Railroad, at Schuylkill Haven,	699,885
Little Schuylkill Railroad at Port Clinton,	273,508
	1,650,270

Where delivered on Line of Reading Railroad.

Station or Turnout.	From Pt. Carbon.	From Mt. Carbon.	From Sch. Haven.	From Pt. Clinton.	Total.
Orwigsburg,	61	10	166	10	247
Port Clinton,	9				9
Hamburg,	310	62	18	342	732
Mohrsville,	104	5		9	118
Between Morhsville and Reading,	1,056	257	72	199	1,584
Reading,	15,516	3,254	21,936	585	41,291
Birdsboro'	743		410	291	1,444
Douglassville,	487	83	239	19	828
Pottstown,	6,055	146	1,253	293	7,747
Limerick,	112	5			117
Royer's Ford,	479				479
Phœnixville,	5,348	109	1,937	26,148	33,542
Valley Forge,	1,155		509		1,664
Port Kennedy,	5,089	79	4,094	5	9,267
Norristown,	3,516		3,022	436	6,974
Furnaces and Lime-kilns below Norristown,	8,163		770	2,763	11,696
Conshehocken,	11,443	4,176	24,813	10,735	51,167
Spring Mill,	1,868	10	469	8,316	10,663
Manayunk,	652			320	972
Falls,	4,653		9,088	13	13,754
Nicetown & Germantown,	1,959	362		2,271	4,592
Junction with State Road,	3,241	49	2,437	1,011	6,738
Philadelphia,	70,483	3,758	83,407	61,761	219,409
Richmond,	357,863	164,147	545,245	157,981	1,225,236
Totals,	500,365	176,512	699,885	273,508	1,650,270

TABLE, *Showing the Business of the Philadelphia and Reading Railroad (each item monthly) for the Year ending November* 30, 1851.

Date.	Travel.	Freight on Goods.	Freight on Coal.	U. S. Mail.	Miscella. Receipts.	Total.
December, 1850.	10,379·32	6,068·93	216,418·93	783·33	526·20	234,176·71
January, 1851.	10,421·62	16,086·47	168,839·99	783·33	930·71	197,062·12
February,	7,720·70	13,852·13	105,600·24	783·34	620·87	128,577·28
March,	10,312·21	9,530·76	135,873·67	783·33	896·88	157,396·85
April,	13,978·49	11,203·62	174,761·73	783·33	857·77	201,584·94
May,	14,296·67	10,448·71	164,484·89	783·34	609·01	190,622·62
June,	13,417·65	7,890·88	147,972·46	783·33	544·36	170,608·68
July,	16,115·98	8,346·50	154,396·88	783·33	598·57	180,241·26
August,	15,558·53	9,671·62	190,699·71	783·34	571·23	217,284·43
September,	14,692·99	10,620·54	186,565·80	783·33	618·88	213,281·54
October,	14,348·07	11,187·23	195,895·43	783·33	559·49	222,773·55
November,	11,189·41	8,764·95	177,361·06	783·34	2,621·66	200,720·42
Totals,	152,431·64	123,672·34	2,018,870·79	9,400·00	9,955·63	2,314,330·40

COAL TONNAGE.

December, 1850,	145,290 3/20	June, 1851,	129,526
January, 1851,	114,077 1/20	July,	141,972 10/20
February,	71,601	August,	173,717 16/20
March,	102,501 6/20	September,	165,730 2/20
April,	134,366 6/20	October,	178,821 7/20
May,	137,162 2/20	November,	155,504 7/20
		Total,	1,650,270

ANTHRACITE COAL TRADE OF THE UNITED STATES.

The following Table exhibits the quantity of Anthracite Coal sent to market from the different regions of Pennsylvania from the commencement of the Trade, in 1820, to 1851 inclusive; together with the Annual Increase, &c., and the Importations of Foreign Bituminous Coal.

Years	SCHUYLKILL.					LEHIGH.	OTHER REGIONS.								
	Canal.	Railroad.	Total.	Pine-grove.	Little Schuylkill.	Total	Lacka-wana.	Wilkes-barre.	Sham'kin	Lykens Valley.	Aggregate.	Annual increase.	Consump-tion.	Sold on line of Schuy'll.	Import of foreign coal.
1820	—	—	—	—	—	365	—	—	—	—	365	—	—	—	—
1821	—	—	—	—	—	1,073	—	—	—	—	1,073	—	—	—	22,122
1822	—	—	—	—	—	2,240	—	—	—	—	2,240	—	—	—	34,523
1823	—	—	—	—	—	5,823	—	—	—	—	5,823	—	—	—	30,433
1824	—	—	—	—	—	9,541	—	—	—	—	9,541	—	—	—	7,228
1825	6,500	—	6,500	—	—	28,393	—	—	—	—	34,893	25,352	—	—	25,645
1826	16,767	—	16,767	—	—	31,280	—	—	—	—	48,047	13,154	—	—	35,665
1827	31,360	—	31,360	—	—	32,074	—	—	—	—	63,434	15,837	—	—	40,257
1828	47,284	—	47,284	—	—	30,232	—	—	—	—	77,516	14,082	—	3,154	32,302
1829	79,973	—	79,973	—	—	25,110	7,000	—	—	—	112,083	34,567	—	3,332	45,393
1830	89,984	—	89,984	—	—	41,750	43,000	—	—	—	174,734	12,651	—	5,321	58,136
1831	81,854	—	81,854	—	—	40,966	54,000	—	—	—	176,820	2,086	177,000	6,150	36,509
1832	209,271	—	209,271	—	14,000	70,000	84,600	—	—	—	363,871	187,051	298,871	10,048	72,978
1833	252,971	—	252,971	—	40,000	123,000	111,777	—	—	—	487,748	123,877	434,986	13,429	92,432
1834	226,692	—	226,692	—	34,000	106,244	43,700	—	—	—	376,636	*decrease.*	415,186	19,429	71,626
1835	339,508	—	339,508	—	41,000	131,250	90,000	—	—	—	560,758	184,122	635,935	18,571	49,969
1836	432,045	—	432,045	—	35,000	148,211	103,861	—	—	—	682,428	121,670	632,428	17,863	108,432
1837	523,152	—	523,152	17,000	31,000	223,902	115,387	—	—	—	881,476	199,048	680,441	21,749	153,450
1838	433,875	—	433,875	13,000	13,000	213,615	78,207	—	—	—	739,293	*decrease.*	788,968	28,775	129,083
1839	442,608	—	442,608	20,639	9,000	221,025	122,300	—	11,930	—	819,327	80,034	867,000	30,390	181,551
1840	452,291	—	452,291	23,860	20,000	225,318	148,470	—	15,505	—	865,414	46,087	973,136	28,024	162,867
1841	584,692	850	584,692	17,653	40'000	143,037	192,270	—	21,463	—	958,899	93,485	958,899	41,223	155,394
1842	491,602	49,902	540,892	32,381	37,000	272,546	205,253	47,346	10,000	—	1,108,001	149,102	1,158,001	40,584	141,521
1843	447,058	230,254	677,295	22,905	31,000	267,793	227,605	58,000	10,000	—	1,263,539	155,538	1,263,539	34,619	41,163
1844	398,887	441,491	839,934	34,916	57,000	377,002	251,005	114,906	13,087	—	1,631,669	368,130	1,631,669	60,000	87,073
1845	263,587	820,237	1,083,796	47,928	74,000	429,453	273,435	178,401	10,000	—	2,023,052	391,383	2,023,052	90,000	85,776
1846	3,440	1,233,142	1,237,002	58,926	91,000	523,002	320,000	192,503	12,572	—	2,343,992	320,940	2,343,992	155,460	156,853
1847	222,693	1,360,681	1,583,374	67,457	106,401	643,973	388,203	284,398	14,904	—	2,982,309	638,317	2,782,309	226,610	148,021
1848	436,602	1,216,233	1,652,835	61,530	162,626	680,746	437,500	237,271	19,356	—	3,089,238	106,929	2,889,238	252,837	196,168
1849	489,208	1,115,918	1,605,126	78,299	174,758	801,246	454,240	259,080	19,650	25,325	3,242,866	153,403	3,125,000	239,290	198,213
1850	288,030	1,423,977	1,712,007	70,919	211,960	722,622	550,417	243,250	19,921	37,763	3,356,614	114,033	4,183,725	207,863	180,439
1851	579,156	1,605,084	2,184,240	—	310,307	989,296	795,095	336,000	24,899	54,200	4,383,899	1,026,831	—	312,367	—
	7,870,618	9,485,710	17,367,328	560,413	1,533,052	7,562,028	5,094,385	1,951,734	193,287	116,338	32,864,735				

On the Discharge of Water over Weirs and Overfalls. By Thomas Evans Blackwell, *M. Inst. C. E.**

Additional Observations, forming Columns 1, 9, *and* 10 *in the Original Tables, Kennet and Avon Canal.*

Continued from page 88.

Thickness of sheet of water taken at the outer edge of overfall plank, or, where there was a wide crest, at the outer end of such crest.

The 1st column is the total depth of water above crest, as given in the tables.

The 2d column shows the height the water rose against a 2-ft rule held flatways against stream.

The 3d column shows the height the water rose against the brass slide of a rule held edgeways.

Heighth above crest.	Flat Rule.	Edge Rule.
	Table III.	
1	1	$\frac{5}{8}$
1	1	$\frac{5}{8}$
4	4	3
4	$4\frac{1}{4}$	$2\frac{11}{16}$
5	5	$3\frac{1}{2}$
5	5	$3\frac{7}{8}$
6	6	$4\frac{3}{8}$
6	6	$4\frac{3}{8}$
8		$6\frac{3}{8}$
	Table IV.	
2	$1\frac{1}{4}$	
3	3	$1\frac{15}{16}$
4	5	$3\frac{1}{2}$
5		$3\frac{5}{8}$
6		$4\frac{3}{8}$
7	$5\frac{1}{8}$	
8	$6\frac{1}{8}$	
9	$6\frac{3}{4}$	
	Table VII.	
1	$1\frac{1}{2}$	$\frac{1}{2}$
4	6	$1\frac{1}{2}$
6	8	1
7	9	$2\frac{3}{8}$
	Table VIII.	
4	$5\frac{1}{2}$	$1\frac{3}{8}$
5	7	$1\frac{3}{4}$
7	8	$2\frac{1}{8}$

Heighth above crest.	Flat Rule.	Edge Rule.
	Table IX.	
$\frac{7}{8}$ to 1	$1\frac{1}{2}$	$\frac{5}{16}$
2	$3\frac{3}{4}$	$\frac{9}{16}$
2	$3\frac{1}{2}$	$\frac{9}{16}$
4	5	$1\frac{1}{2}$
6	$8\frac{1}{4}$	$2\frac{1}{4}$
8	9	$3\frac{1}{2}$
	Table X.	
1	1	$\frac{7}{16}$
2	2	$\frac{7}{8}$
4	$4\frac{1}{2}$	$1\frac{3}{8}$
5	5	$2\frac{1}{4}$
6	6	$2\frac{1}{2}$
6	6	$2\frac{1}{8}$
	Table XI.	
1 to $1\frac{1}{4}$	$1\frac{1}{8}$	$\frac{1}{2}$
3	3	$1\frac{1}{8}$
3	$2\frac{7}{8}$	$1\frac{1}{2}$
6	6	$2\frac{3}{4}$
9	$8\frac{1}{4}$	$4\frac{1}{8}$
	Table XII.	
1	$\frac{7}{8}$	$\frac{7}{16}$
2	2	$\frac{7}{8}$
2	2	$\frac{13}{16}$
5	5	$1\frac{3}{4}$
6	6	$2\frac{5}{8}$
8	$7\frac{1}{2}$	$3\frac{3}{8}$
9	$8\frac{1}{2}$	$3\frac{1}{2}$
10	9	4

One of the general laws that appears to be indicated by these experi-

ments, is that in thin plates, the coefficient is highest at the smallest head observed, and that it reaches the mean, at a head of about 3 inches; after which it continues to decrease as the head increases.

For a plank 2 inches thick (which represents the ordinary form of waste-board,) these experiments show, that beginning with a head of 1 inch, the coefficient is less than the mean; that it reaches its mean earlier, as the length of the weir is greater, being in average cases at about the head of 3 inches; and that it then rises higher than its mean, till it reaches the head of about 9 inches; when it is again depressed below the mean.

One remarkable circumstance was found to prevail in a great number of these experiments, viz., that the head of about 4 inches gave a less quantity than could be arrived at by interpolating the results of the experiments with heads of 3 inches and 5 inches. It is not easy to explain the causes tending to produce this depression; but the fact was striking and well established.

A similar result occurred, at about the same head, in the other set of experiments made at Chew Magna.

A few experiments, which were made for ascertaining the effect of converging wing-walls, will demonstrate the great advantages known to be attendant on such a form, as will be seen by comparing the results on the weir of 10 feet in length with and without such wings. The mean coefficients for the two cases were 371 without, and 459 with the wings; the splay of the wings being an angle of 54°.

The circumstance attending the set of experiments at Chew Magna makes the discharges of them analogous to the case of a weir in a river, or in a running stream; but among themselves there are anomalies equally remarkable with those on the canal. The overfall bar was here invariably 2 inches thick, and the length was always 10 feet. The coefficients, up to a head of 3 inches, are below the mean; above that head they fluctuate considerably; but generally they keep above the main line. These anomalies are difficult to account for; the experiments having been very carefully made, and such causes of error as might have arisen are not sufficient to explain them; they are therefore left as facts, to be added to, or elucidated, by the researches of others.

Appendix.

Table *showing the Variation of the Coefficients for different Species of Overfall.*

Species of Overfall.	Length in feet.	Mean Coefficients. m.	k.
Thin Plate,	3	·421	·080
"	10	·445	·086
Plank 2 inches wide,	3	·380	·073
" "	6	·377	·072
" "	10	.371	·072
" " (with wings,)	10	·459	·090
Bar 2 inches wide, (Chew Magna,)	10	·480	
Crest 3 feet wide, slope 1 in 12,	3	·338	·065
" " 1 in 18,	3	·339	·065
" " "	10	·337	·065
" " Level,	3	·311	·060
" " "	6	·322	·061
" " "	10	·314	·061

Table showing the Variations of the Coefficients for different Heads of Water.

Number of Experiments, and Species of Overfalls.	Mean Coefficient (m_1) applicable to Formula (I.)		Mean Coefficient (k_1) applicable to Formula (II.)	
	Head in Inches.	Coeff't.	Head in Inches.	Coeff't.
6. Thin plate 3 feet long,	1 to 3	·440	1 to 2	·085
	3 " 6	·402	3 " 6	·078
11. Thin plate 10 feet long,	1 " 3	·501	1 " 3	·096
	3 " 6	·435	3 " 6	·086
	6 " 9	·370	6 " 9	·072
23. Plank 2 inches thick, 3 feet long,	1 " 3	·342	1 " 3	·066
	3 " 6	·384	3 " 6	·074
	6 " 10	·406	6 " 10	·077
56. Plank 2 inches thick, 6 feet long,	1 " 3	·359	1 " 3	·069
	3 " 6	·396	3 " 6	·077
	6 " 9	·392	6 " 9	·074
	9 " 14	·358	9 " 14	·069
40. Plank 2 inches thick, 10 feet long,	1 " 3	·346	1 " 3	·068
	3 " 6	·397	3 " 6	·076
	6 " 7	·374	6 " 7	·072
	9 " 12	·356	9 " 12	·069
4. Plank 2 inches thick, (with wings,) 10 feet wide,	1 " 2	·476	1 " 2	·092
	4 " 5	·442	4 " 5	·087
7. Overfall with crest 3 feet wide, sloping 1 in 12, 3 feet long,	1 " 3	·342	1 " 3	·066
	3 " 6	·328	3 " 6	·063
	6 " 9	·341	0 " 6	·066
9. Overfall with crest 3 feet wide, sloping 1 in 18, 3 feet long,	1 " 3	·362	1 " 3	·070
	3 " 6	·315	3 " 6	·061
	6 " 9	·332	6 " 9	·064
6. Overfall with crest 3 feet wide, sloping 1 in 18, 10 feet long,	1 " 4	·328	1 " 4	·063
	4 " 8	·350	4 " 8	·068
14. Overfall with crest 3 feet wide, level, 6 feet long,	1 " 3	·305	1 " 3	·059
	3 " 6	·311	3 " 6	·060
	6 " 9	·318	6 " 9	·061
15. Overfall with crest 3 feet wide, level, 6 feet long,	3 " 7	·330	3 " 7	·062
	7 " 12	·310	7 " 12	·060
12. Overfall with crest 3 feet wide, level, 10 feet long,	1 " 5	·306	1 " 5	·059
	5 " 8	·327	5 " 8	·063
	8 " 10	·313	8 " 10	·061
61. Chew Magna. Overfall bar, 2 inches thick, 10 feet long,	1 " 3	·437		
	3 " 6	·499		
	6 " 9	·505		

Mr. Blackwell, having explained the tables and the diagrams illustrating the paper, stated that his object in bringing the subject before the Institution had been, to make known certain recorded facts; and he conceived that from these experiments some useful deductions might be drawn, which he trusted would induce other members to make similar investigations.

Mr. Simpson said, the experiments at Chew Magna were undertaken to settle a question, as to the discharge from some reservoirs connected with the Bristol waterworks. These were always kept to a nearly uniform level; but as the water was discharged by a sluice, 19 feet in height, at the rate of about 4 feet per second, there was a slight agitation of the water in the reservoir which would account for some of the anomalies in

the experiments alluded to by Mr. Blackwell. On the whole, he did not think these anomalies were greater than was met with in similar cases, when the country was precipitous, and the water was delivered from a high reservoir into a still pool, and then gauged through notch boards. The Wynford brook, on which the reservoir at Chew Magna was situated, fell about 90 feet in a mile, and floods had been recorded which discharged seventy times the ordinary flow of water. The experiments had been carefully made, and gave, he believed, correct results in all cases.

Mr. J. Scott Russell thought Mr. Blackwell's experiments had been conducted in a most useful manner, and on a sufficiently large scale to be applicable to general practice; and he would rank them higher, and considered them more trustworthy, than those made by Du Buat and D'Aubuisson; as those made by Du Buat, though on a large scale, were far from the truth, and those by D'Aubuisson, though better in character, were made on too small a scale to be of practical utility. As far as he had been able to understand Mr. Blackwell's formula, nothing more was meant by it than the nearest approach to a general law, and the difference between it and each practical experiment being ascertained, showed how much the coefficient required to be altered so that the formula and the experiment might coincide. Then the mean of the coefficients of that class of experiments might be taken as a general coefficient for that class, and the difference between it and the coefficient in each experiment would be the measure of discrepancy between the two. The experiments differed so considerably from one another, that the method adopted was the only rational one; because if they took any isolated experiment, and put it down as a fact to be followed in other cases, it would lead to erroneous conclusions. He believed, therefore, the mean of the coefficient was the only thing which would represent the truth, so far as it resulted from experiment. The first table exhibited seemed to him to show, not so much the law of overflow, as the deviations from the supposed law; whilst the diagram appeared to show the law which the delivery followed, as determined by the height of head, under different circumstances of breadth of overfall. And the two together conveyed to his mind a very simple and clear view of the results of all the experiments which had been compared together, so that in order to apply these results to practice, it was only necessary to take the height of head, as given in that table, and the quantity discharged by a unit of breadth, and then to judge which of these most nearly approached the case under consideration. With regard to the discrepancies, which had been noticed by Mr. Blackwell, in the Chew Magna experiments, he believed they might be attributed to the variations of the velocity, caused by the current of the stream entering the reservoir; for he had himself seen, in a reservoir 120 feet wide, that a small stream running into it with a velocity of 4 feet per second, caused the water in the reservoir to be disturbed for a distance of 100 feeet; indeed, formed a distinct current for that distance. This proved how necessary it was to notice every minute fact when recording each observation. It would be a great boon to the profession, if the members of the Institution would make a point of transmitting the results of experiments on any question; and it was exactly that kind of contribution which the younger members could make with so much certainty, and with so much advantage to themselves and the profession; for whilst, on the

one hand, the collection of well authenticated facts induced a habit of accurate research; on the other hand, it brought to the older and more experienced members, the means of drawing general conclusions, and of deducing correct rules from actual experiments.

Mr. Hawksley coincided with the expression of the general value of the results of the experiments, as a record of observed facts. He thought, however, that these experiments had been made under such widely different circumstances, that they would not be available for the determination of a satisfactory formula. He had also made a considerable number of experiments, to determine the value of the coefficient to be used with the ordinary formula, for measuring the flow of water over a "notch-board." These experiments were made on a brook, in which six gauge boards were fixed, having notches, edged with iron, and of different widths and depths. The velocity of the current in the pond, above each notch, was reduced as much as possible, and the water discharged, after passing successively over all the boards, was at last accurately weighed, by a machine constructed for the purpose. Each notch of necessity discharged the same quantity of water in the same time; consequently, if the formula employed by Mr. Hawksley was correct, it must necessarily give the same result over all the differently formed notches, and finally coincide with the determination of the quantity by the process of weighing. This was so nearly the fact, that the maximum error did not exceed one-sixteenth part of the whole. On some future occasion he would take an opportunity of placing these and other hydraulic investigations, before the members of the Institution.

Mr. Cawley believed, that if the diagrams exhibited by Mr. Blackwell were carefully studied, the discrepancies, which at first sight seemed to exist, would vanish, and they would be found to be attributable, almost invariably, to friction. Where the water passed over a thin plate, there was comparatively little or no friction at the sides, and therefore the coefficient would accurately represent the discharge for every width of overfall; but when the height of the head of water was greater, or the overfall had wings, the case was different, as then there would be a considerable amount of friction, varying, of course, with different circumstances.

Mr. S. Ballard stated, that in September, 1836, he had made a series of experiments, for Mr. T. Rhodes, on the flow of water over weirs, on the river Severn, at Powick, near Worcester. These experiments were made with a weir 2 feet long, formed by a board standing perpendicularly across a trough. The results are given in the following table:—

Depth of Water flowing over the Weir, in inches.	Cubic Feet per Minute over 1 foot of Weir.	Depth of Water flowing over the Weir, in inches.	Cubic Feet per Minute over 1 foot of Weir.
1	5·88	4	46·87
1¼	7·14	4¼	49·45
1½	9·55	4½	54·87
1¾	12·37	4¾	59·60
2	14·93	5	63·38
2¼	18·29	5¼	66·17
2½	23·07	5½	73·17
2¾	27·69	5¾	77·58
3	32·14	6	82·56
3¼	34·61	7	102·27
3½	37·81	8	126·76
3¾	41·47		

At the commencement of these experiments, satisfactory results could

not be obtained, on account of the difficulty of observing the exact depth of water on the weir, for a gauge, which had been set up at the side, did not clearly show the height, owing to the capillary attraction. The method then adopted was to attach two needles to the lower end of an accurately graduated gauge, one of which was a very little longer than the other, so that on the water being admitted by a sluice regulated by a screw, its level was adjusted until it just touched the longest needle, and occasionally, by its uneven motions, the shortest needle, and thus the exact height of the water above the weir was observed. The water, after passing over the weir, fell into a square tank, capable of holding 300 cubic feet, in which a gauge, graduated so as to show every 10 feet of water, was fixed. This gauge had a floating guard around it for keeping the water still, so that the exact height could be taken; and for the purpose of showing clearly when the water arrived at each 10 feet mark, a pin was placed at right angles to the gauge, and the instant the water touched, it was immediately seen. As it was thought that the perpendicular position of the board forming the weir might have some effect in diminishing the quantity of water passing over it, a sloping board, inclining on the upper side, from the top of the weir downwards, was substituted, when the quantity of water discharged was increased, with 1 inch depth of water, from 5·88 cubic feet per minute to 6·76 cubic feet per minute, or about 15 per cent. Experiments were subsequently made with a weir of only one foot long, when the quantity of water discharged was less, in proportion, than it was with the 2 feet weirs. This was attributed to the contracted stream caused by the direction of the course of the water at the sides of the weir. Experiments were also tried with oblique weirs, and circular weirs, and the result was, that the quantity of water discharged was in proportion to the length of the weir.

Extract from the Report to the Secretary of the Treasury on Light-Houses of the United States.

The Board, after examining, with a patience and a zeal which they believe this important branch of the public service to demand, the different points to which their attention was specially called by the instructions of the Department, have arrived at the following conclusions, which they feel assured will be found to be fully sustained by the detailed data in this report, and its appendix, upon which they are chiefly based:

1. That the light-houses, light-vessels, beacons, and buoys, and their accessories in the United States, are not as efficient as the interests of commerce, navigation, and humanity demand; and that they do not compare favorably with similar aids to navigation in Europe in general, but especially with those of France and Great Britain, and their dependencies.

That the light-house establishment of the United States does not compare favorably in economy with those of Great Britain and France.

That, while the superiority of the European lights to those of the United States, (arising from the greater care and attention bestowed upon them, the better and more expensive apparatus employed in them, the larger number of keepers to the lights, the more rigid superintendence

and frequent visitations for inspections and for delivery of supplies,) renders any just comparison of them in annual expense in money impossible; it is shown that the difference for maintenance per lamp per annum is very small, and that not invariably in favor of those of this country.

That the towers and buildings have not been constructed in general of the best materials, nor under the care and supervision of competent or faithful engineers.

That the want of professional knowledge of the materials, mortars, cements, &c., &c., for construction and repairs, or faithfulness on the part of those charged with the duty, was apparent in nearly all the modern towers and buildings visited by the Board.

That the present large sums annually required for renewing, renovating, and repairing towers and buildings, are the consequences of the want of an efficient organization, which could afford the necessary professional ability for plans, drawings, and superintending of constructions and repairs.

That the towers are deficient in the necessary proper accommodations for oil and other supplies; in the mode of fitting them up, and in the materials employed for the interior work; and the buildings ill adapted to the comfortable accommodation of the keepers.

That the lanterns are, as a general rule, of improper dimensions, constructed of ill-adapted, and, in the end, not economical materials, without professional or scientific skill; and, in many instances, not suited to the use for which they are designed.

That there is no proper system of ventilation for lanterns.

That the means said to be employed for ventilating are wholly inadequate, and contrary to true scientific principles.

That there is very little attention paid to the painting of the interior of the lanterns and astragals, and in glazing.

That, under a well organized system, the lights and other aids to navigation might be greatly increased in number and efficiency, at a large saving upon the present annual cost.

That there has never been an efficient systematic plan of construction, illumination, inspection, and superintendence of lights, &c., &c., in the United States.

That towers and buildings have been constructed without regard to the wants of the service, and to the peculiarites of localities, and the special design of the lights themselves.

That the light-house towers, buildings, and vessels visited by the Board were not, in general, found to be in a creditable state of preservation and repair.

That the inferiority of illuminating apparatus in the light-houses of the United States renders its renewal frequently necessary, at great expense, and never produces as effective a light as it is capable of making.

That the reflector apparatus employed in the light-houses of the United States is greatly inferior to the requirements of the service, being defective in form, materials, and finish.

That the illuminating apparatus in the United States is of a description now nearly obsolete throughout all maritime countries, where the best

apparatus of that description was employed, prior to the introduction of the Fresnel lenses, as substitutes.

That the sea-coast reflector lights are, in general, too low, and are deficient in power and range.

That our sea-coast reflector lights are not fitted with a sufficent number of lamps and reflectors to produce the greatest amount of usefulness, which the imperfect system of lighting with the reflectors will produce.

That the lamps and reflectors are not, as a general rule, properly placed on the frames, due regard not being paid to divergency.

That the sea-coast lights are deficient in proper attendance, with only one keeper.

That there is no proper classification of lights in the United States.

That the lights are not properly and sufficiently well distinguished along the coast of the United States.

That there is no system of public inspection and superintendence, calculated to render the light-house establishment moderately useful or efficient.

That the lanterns, illuminating apparatus, &c., are not superintended, while they are being made, by competent or faithful professional men.

That there are no general or special regulations for keepers and others connected with light-houses, by which to insure an intelligent or faithful performance of the duties.

That supplies of all kinds, involving the good or bad quality of the lights to a great extent, are not tested and selected by competent persons before issuing them to light keepers.

That there is not a proper degree of responsibility on the part of the agents connected with the light-house establishment.

That the present mode of procuring and distributing supplies, apparatus, &c., is not calculated to insure either efficiency or economy in the service.

That contractors are not held under a sufficiently rigid superintendence and inspection during the execution of works of construction and repair.

That the modern light-house towers are inferior in point of materials and workmanship to the older ones visited by the Board; such, for example, as Sandy Hook light-house, built in 1762; Cape Henlopen tower, built in 1764; Cape Henry tower, built in 1791.

That the floating lights of the United States are comparatively useless, for want of efficient lamps and parabolic reflectors.

That the light vessels are in general not adapted to the service they are required to perform, being defective in size, model, and moorings.

That the light vessels are not properly distinguished either by day or by night.

That sufficient regard has not been had to the proposed use of the several lights, so as to regulate their power and range accordingly.

That there is no effective system by which to afford to sparsely settled parts of the coasts requiring lights, the means of bringing the subject before Congress, and of deciding in advance of appropriations the best descriptions of lights to be placed at the desired points.

That many of the small lights have an unnecessary number of lamps and reflectors, while sea-coast lights are greatly deficient in them.

That in the form and adjustment of the reflectors, sufficient attention is not paid to the range and other circumstances of the required lights, involving scientific principles.

That there is not, in useful effect, a single first class light on the coast of the United States.

That the lights at Navesink (two lenses), and the second order lens light at Sankaty Head, Nantucket, are the best lights on the coast of the United States.

That there are very few, if any, reflector lights on the coasts of the United States better in useful effect than the third order lens light (larger model) erected by the Topographical bureau on Brandywine shoal, while the economy of the lens light is in the ratio of at least 4 to 1.

That the lens lights at Navesink, Sankaty Head, and Brandywine shoal are considered to be, as a general rule, equal to European lights of the same classes.

That the Fresnel lens is greatly superior to any other mode of light-house illumination, and in point of economy is nearly four times as advantageous as the best system of reflectors and Argand lamps.

That the buoys in the waters of the United States are defective in size, shape, and distinction, as a general rule; and that sufficient care is not taken, nor competent persons employed, to place, moor, and replace them.

That the moorings of buoys are not sufficiently heavy, and the chains not properly tested as to size and strength.

That the sea-coast lights along the southern coast from the highlands of Navesink, are comparatively useless to the mariner for want of sufficient power and range.

That the dangerous obstructions to navigation around Cape Florida, from the Gulf of Mexico, are not properly lighted and otherwise marked to aid navigators.

That the entire southern coast of the United States requires additional lights and other aids to navigation, to render human life and property safe.

That, for want of an efficient organization, there is no systematic plan adopted on any part of the coast of the United States for rendering navigation safe and easy by means of lights, beacons, buoys, &c., &c.

That lights and other aids to navigation are provided, as a general rule, through the action of Congress upon petitions emanating from persons having a local interest, or from boards of pilots, insurance offices, chambers of commerce, &c., &c.

That under a proper organization, the officers of the light-house establishment would collect information from reliable sources, decide upon the doubtful points, and recommend to Congress all cases of sufficient importance to warrant appropriations.

That the approaches to some of our principal and most important harbors, bays, &c., are not sufficiently lighted and marked to render steam navigation as rapid, easy, and safe, as the wants of commerce demand, especially to New York, Delaware, and Chesapeake bays, and some of their tributaries.

That the duty of lighting and marking with beacons, buoys, and sea-marks, our extended sea, lake, gulf, bay, sound, and river coast, efficiently

and economically, can only be performed by persons of professional experience and undoubted ability upon a systematic plan, based upon the principles of the most approved light-house engineering.

That there is no efficient system of inspection and superintendence of lights in the United States.

That the light-keepers, in many cases, are not competent, and in no instances have they been instructed in reference to their duties, nor examined to ascertain their ability to perform the duties faithfully.

That the supplies of oil, chimneys, wicks, &c., &c., are not tested and selected with sufficient care, or by competent or faithful agents.

That there is no proper system of distributing the supplies to light keepers.

That proper attention is not given to purchasing and distributing supplies.

That the cleaning powder used in our light-houses is injurious to the reflectors, and not such as is used in other light-house establishments; and other articles are equally defective.

That there is no system in the management of the light-house establishment of the United States.

That the instructions to light-keepers to light, trim, and extinguish the lights at certain specified times are not enforced, to the detriment of the service, and to the imminent risk of endangering vessels in their vicinity.

That such knowledge is not imparted to light-keepers, as a general rule, to enable them to keep their lamps, burners, reflectors, and lanterns in such order as to insure the best lights from the existing apparatus.

That frequent and rigid inspections and superintendence by competent persons are necessary to insure an efficient and economical light-house service.

That competent keepers, responsible to the Government through inspectors, are indispensable to insure good lights at all times.

That supplies are not delivered at sufficiently short intervals of time to the lights.

That the present mode of repairing illuminating apparatus, oil tanks, &c., &c., is not economical, efficient, or reliable.

That the removal and replacing of light vessels, the extinguishment or lighting of lights, removal or placing of buoys, &c., or in any manner changing lights and other aids to navigation, without giving ample notice, are subjects of grave complaints.

That there is no good reason why the light vessels on the coasts of the United States (if properly constructed and moored) should not remain at their moorings under as unfavorable circumstances as those on the coasts of England and Ireland.

That whenever light vessels are reported to have parted their moorings, the circumstances attending them should be carefully investigated by competent and disinterested persons, and the result made known.

That the erection of light-house towers of a uniform height, without regard to the elevation of the land upon which they are placed, is contrary to the first principles of light-house engineering, involving, in situations of great natural elevations above the level of the sea, unnecessary

expense, and on low coasts the inefficiency of the light for want of sufficient range.

That due regard has not been had to the wants of commerce in selecting sites for lights along the coasts of the United States.

That for want of a proper system in this branch of the public service, the densely populated coasts have a superabundance of lights, to the injury of navigation, while on the sparsely settled coasts, bounding the great outlet to the millions of commerce from the valley of the Mississippi and its tributaries for hundreds of miles, there is not a single light.

That light-house construction, illumination, inspection, and superintendence, involve a large amount of special and general professional knowledge of a high character, and therefore should only be entrusted to the most competent professional persons.

That competent engineers have not been employed, except in a few instances, to plan and superintend the construction and fitting up of the light-houses of the United States.

That the large amounts required annually to repair and keep in good order the towers, buildings, vessels, and illuminating apparatus of the lights in the United States, is attributable to the manner in which the work was executed, and to the inferiority of the materials employed.

That large sums are now required to preserve foundations of light-towers, sea-walls, &c., which might have been saved by the adoption, by competent engineers, of proper plans and foundations for them.

That no systematical and economical plan of construction has been employed in the light-house establishment.

That changes are constantly taking place in the aids to navigation, without any official notice being given to the public of them, which are calculated to mislead mariners.

That there is no proper system of beaconage and buoyage, nor any list of them, by which the navigator, who is not familiar with the coast, can derive any benefit.

That the list of light-houses and light-vessels is defective in many respects; and it, at present, affords very little information to the navigator, and is, in some respects, erroneous.

That there is no regular systematic or effective mode of giving notice to mariners of proposed changes in lights, &c., &c., or of any that may have been destroyed or removed by the action of the sea or winds.

That the buoys are not properly painted according to law, nor are they in other respects properly distinguished one from another.

That light-houses and light-vessels are not sufficiently well distinguished by day.

That the buoys are not properly placed, nor replaced when driven from their positions, and without delay.

That buoys are not placed upon new shoals, over wrecks, &c., except by a special act of Congress, through the agency of some philanthropic or interested person.

That spare buoys are essential for all harbors and rivers in sufficient numbers to allow for all casualties, and for cleaning, painting, &c., &c.

That there is no code or manual of instructions to guide light keepers and others connected with the light-house service, in the performance of

their duties in this country, as is found in every well regulated light-house establishment elsewhere.

That there is no meteorological reason for the lights of the United States being worse than those of equal class and importance in England and France.

That there are no proper books of daily expenditure kept; no returns of daily expenditure made of a reliable character; and the lights are deficient in all the essentials for the faithful performance of this duty, such as books, forms, registers, &c., &c.

That light keepers should be required to devote all their time to the care of the lights under their charge, and should not be allowed to attend to their ordinary affairs, to the injury of the service.

That if all our present lights were fitted with lens apparatus of equal power to the reflectors now in use, the annual expense for supplies of oil and cleaning materials would cost little more than one-fourth as much as is now expended for these articles of supply annually; that is, that the supplies now costing upwards of $152,000, would not exceed $38,000 to $42,000, making an annual saving of $110,000 to $115,000.

That in addition to the greater superiority in brilliancy, power, and economy of the lenses, compared to the reflectors, they possess the great advantage of durability, to the extent of never requiring to be renewed.

The Board therefore recommend:

That the general programme for improving the sea-coast lights of the United States, and of making necessary additions, be adopted as the basis of future recommendation and legislation.

That the Fresnel or lens system modified in special cases by the holophotal apparatus of Mr. Thomas Stevenson, be adopted as the illuminating apparatus for the lights of the United States, to embrace all new lights now or hereafter authorized, and all lights requiring to be renovated either by reason of deficient power or of defective apparatus.

To be Continued.

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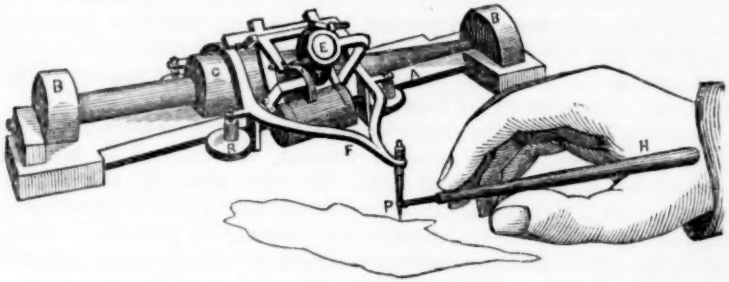
*Description of Sang's Platometer, or Self-Acting Calculator of Surface.**

The usual method of discovering the area of a figure drawn on a plan is, to divide it into a number of triangles or trapeziums—to measure the base and altitude of each, and take the sum of their products. By a careful process of this kind, the area may be discovered with great accuracy; but as it is necessary to revise the calculations several times, both for the purpose of obviating faults in the arithmetical part of the work, and in order, by taking the average of a few independent measurements, to increase the probable accuracy of the result, this method of calculation, especially when the figure is irregular, entails a considerable amount of labor of an irksome kind. Attempts have been made to avoid this by cutting the figure from the sheet of paper, and weighing it in a delicate balance against weights consisting of parts of the same paper, of determinate sizes; but this method, at first sight simple and practical, is rendered of little use by the impossibility of obtaining paper of uniform

* From the Glasgow Practical Mechanic's Journal, December, 1851.

thickness throughout the sheet, the variation of thickness, and hence of weight, being greater than the amount of error that could be allowed in the results.

The instrument invented by Mr. Sang, of Kirkaldy, represented in our perspective figure, indicates the area of any figure, however irregular, on merely carrying the point of a tracer round its boundary, and, besides the advantage of not injuring the drawing, it possesses that of speed and accuracy. A frame, A, carries an axle, which has on it two rollers, B, of equal size, and a cone, C. It is heavy, so that it maintains its parallelism on being pushed along the paper. The sides of the frame are parallel to the edge of the cone, and are fitted to receive the circumference of four friction rollers, R, which move along A, and carry a light frame, F, terminating on the tracing-point, P, to which the handle, H, is attached by a universal joint. The frame, F, also carries a wheel, I, which, by means of a weight, is pressed on the surface of the cone, and receives motion from it as the tracer is carried along the paper. The index-wheel, I, only touches the cone by a narrow edge, the rest of its circumference being of smaller diameter, and containing a silver ring divided into 200 parts, which are again subdivided by a vernier into 2000 parts. The value of each of these divisions is the $\frac{1}{1000}$th part of a square inch; so that one turn of the wheel represents 20 inches. Another index-wheel, T, moved by I, is divided into five parts, each of which represents 20 inches, so that a complete revolution of T values 100 inches. The eye-glass, E, assists in reading the divisions and vernier.



It is apparent, from the construction of this instrument, that if the tracer be moved forward, it will cause the index to revolve, not simply in proportion to that motion, but in proportion to the motion of the tracer multiplied by the distance of the edge of the index-wheel from the apex of the cone; and that the revolving motion of the index-wheel will be positive or negative, according as the tracer is carried backwards or forwards. Hence, if the tracer be carried completely round the outline of any figure, on arriving at the end of its journey, the index-wheel will show the algebraic sum of the breadth of the figure at every point, multiplied by the increment of the distance of the points from the apex of the cone; that is to say, the area of the figure.

This instrument possesses great simplicity of construction. Both factors of the continuous multiplication are directly transmitted from the motion of the tracing point in the simplest manner. The influence of the elasticity

of the parts of the machine on the accuracy of its indications, may be discovered by moving the tracer a second time over the boundary of the figure, after having turned the whole instrument round 180°. The effects of the imperfections in the mechanism will now have changed signs, and one of the results will probably be found to be a little too large, and the other a little too small. The average between the two is the exact area of the figure, and is more to be depended on than the results of measurements made by scale and calculation in the usual way. A careful operator, in using the platometer, will always take the average of two tracings in this manner; but when he experiences the rapidity with which this may be done, he will find the trouble as nothing in comparison with the harassing labor of calculating by scale and multiplication.

Rules for Solid Mensuration. *By* ELLWOOD MORRIS, *Civil Engineer.*

The following letter, addressed to a member of the Institute, is published with the consent of the writer. It presents to our readers a very interesting generalization, and it is hoped that Mr. Morris may soon favor us with a theoretical demonstration of his application of the prismoidal rule.

DEAR SIR:—In the course of my practice as a Civil Engineer, the frequent occasion I have had for the employment of the ordinary rules of *solid mensuration*, naturally drew my attention to their redundancy as laid down in the books, for the solution of particular cases; and some years ago, in several papers published in the *Journal of the Franklin Institute*, on the application of the "*prismoidal formula*" to the mensuration of excavation and embankment, I pointed out the fact, that this formula is *the fundamental rule for the mensuration of solids;* and that the rules of the books are merely particular cases, in which, by the elimination of certain terms, fewer figures are required.

Reflecting then upon the immense mass of matter necessary to be committed to memory by the modern scholar, it occurred to me, that it would be much better to teach this rule alone in the schools, than to burden the pupils' minds unnecessarily with a host of special rules, which are in fact particular cases of the "*prismoidal formula*," though none of the works on mensuration have ever pointed out their connexion and dependency.

Not having time to develope this matter so fully in scientific language, as to command the attention of the mathematicians of the country, and failing then to enlist the interest of those to whom I mentioned it, I had dismissed the subject from my mind, until recalled to it incidentally by a recent conversation with yourself.

Busied at the present moment in preparations to take the field upon an important professional service, I have only time to call your attention to a number of leading rules of solid mensuration, which are superseded by the "*prismoidal formula;*" a formula in itself so simple, that it may be committed to memory in five minutes' time, by any child of ordinary capability.

The leading rules of solid mensuration laid down in the books, separate rules being given for each solid, are the following, every one of which may be superseded by the "*prismoidal formula.*"

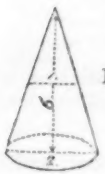
1. To find the solidity of a Cube.
2. " " Parallelopipedon.
3. " " Cylinders and Prisms.
4. " " Cones and Pyramids.
5. " " Frustum of Cone.
6. " " Frustum of Pyramid.
7. " " Wedge.
8. " " Prismoid.
9. " " Sphere.

A number of other special rules are given for the solidity of spheroids, paraboloids, and other solids of revolution, their spindles and segments; to many of which our formula is also applicable; but for the purposes of this communication, it may be sufficient to show, by actual figures, working out examples of the most unpromising cases, the applicability of the "*prismoidal formula*" to compute the solidity of *a cone*, *a wedge*, *a sphere*, and *a hemisphere*. I may here mention, that its accurate application to spheres and spheroids (solids of curved surface) has excited the surprise of many mathematicians, who were prepared to admit its fitness for the mensuration of right lined or plane bounded solids.

By the Special Rules of the Books.

To find the solidity of a Cone.

Rule.—Multiply the area of the base by the height, and one-third of the product will be the solidity.



Given.—A cone having a diameter at the base of 2, and a height of 6. Query: The *solidity?*

$2\times2\times\cdot7854 = 3\cdot1416$

Mid. diam. $=1$. $\quad 6$

$3)18\cdot8496$

Solidity $= 6\cdot2832$

By Prismoidal Formula.

The Prismoidal Formula is,—Add into one sum the areas of the two ends, and four times the middle section parallel to them; then this sum multiplied by one-sixth of the height will give the solidity.

In the case of the cone opposite, the diameter of the base being 2, and of the mid section 1, we have, by the prismoidal formula,

Base, $2\times2\times\cdot7854 = 3\cdot1416$

4 times mid sec. $1\times1\times\cdot7854\times4 = 3\cdot1416$

Top $= 0\cdot$

$\frac{6}{6} = \frac{1}{6}$ ht. $= 1\cdot\times6\cdot2832$

Solidity, . . $= 6\cdot2832$

To find the solidity of a Wedge.

Rule.—To the length of the edge, add twice the length of the back; multiply this sum by the height of the wedge, and then by the breadth of the back: one-sixth of the product will be the solidity.

Given.—A wedge; length of edge 60, back length=20, back breadth=10, height 100. Query: *Solidity?*

Length of edge, . $= 60\cdot$

Twice back, $20\times2 = 40.$

$100.$

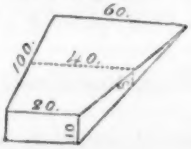
100

$10,000$

10

$6)100,000$

Solidity $= 16,666\frac{2}{3}$



Wedge—Solidity by prismoidal formula.

Area of base, . $20\times10 = 200$

Four times mid sec. $40\times5\times4 = 800$

Top, . . $= 0$

$\frac{100}{6} = 16\frac{2}{3}\times 1000$

Solidity, . $= 16,666\frac{2}{3}$

We will now take the case of a sphere, to which nearly all mathematicians have at first sight denied the applicability of the "*prismoidal formula.*"

By Special Rules.

To find the solidity of a Sphere.

RULE.—Multiply the cube of the diameter by decimal ·5236, the product will be the solidity.

Given.—A sphere of a diameter or axis in length =12. Query: The solidity? Then

12×12×12×·5236 =904·7808 solidity.

By Prismoidal Formula.

Solidity of the Sphere opposite.

Top	= 0
Four times mid sec.	
12×12×·7854×4	=452·3904
Base	= 0
	452·3904
$\frac{1}{6}$ ht. $=\frac{12}{6}$	=2
Solidity	=904·7808

Solidity of a Hemisphere.

Take the same dimensions as in the sphere above, and we have—

2)904·78

Solidity of hemisphere =452·39

Solidity of a Hemisphere.

Diameter of mid section	= 10·392
Diameter of base	= 12
Height or radius	= 6
Then by Prismoidal Formula—	
Area of base	=113·097
Four times mid sec.	
10·392×10·392×·7854×4	=339·272
Top	= 0
	452·369
$\frac{1}{6}$ ht. $=\frac{6}{1}$	
Solidity	452·369

The difference in the last decimals is owing to too few decimal places having been used in the computation.

For the sake of illustration, it is not necessary to go any further, and I think you will, on examination, admit that the "*prismoidal formula*" possesses some curious and useful properties; and that its adoption in the schools in teaching solid mensuration, would alleviate materially the tasks of the scholar.

Pittsburg, February 7, 1852.

AMERICAN PATENTS.

List of American Patents which issued from February 10th to 24th, 1852, (*inclusive,*) *with Exemplifications by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

15. For an *Improvement in Shoe Brushes;* John Jay Adams, Boston, Massachusetts, February 10.

Claim.—"I therefore claim as my invention, the brush as constructed substantially as represented in figure 2, and as above described; that is to say, with its polishing and blacking bristles arranged essentially as exhibited in the said figure and as above explained."

16. For an *Improvement in Watch-Chain Swivels;* Samuel Y. D. Arrowsmith, City of New York, February 10.

"The nature of my invention consists in the construction of a swivel with the rotating parts concealed, and with but one spring to operate on both ends, which spring passes through the entire centre of the shaft."

Claim.—"What I claim as my invention is, 1st, the making swivels with a central spring to operate at both its ends against the knuckles of the joints, and for closing the opening, substantially as described.

"2d, In combination with the swivel so made, I claim the swivel joint made substantially as described."

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17. For *Hose Coupling;* Albigence W. Cary, Brockport, New York, February 10.

"The nature of my invention consists in providing a spring, clasp, or band, of any suitable material, of such a form, that a part of one or both ends shall extend beyond the place of fastening, the object of such extension being to secure the uninterrupted pressure or contracting force of the clasp around the entire circumference of an inserted tube, and thus form a joint which shall be perfectly water tight under any hydraulic force which the hose shall sustain."

Claim.—"I do not claim as my invention, the clasp in its general form, or as made to spring and used with a screw; I claim the clasp of the particular form above described, having a part of one or both ends extended beyond both places of fastening, so as to extend the contracting pressure directly around the entire circumference of an inserted tube, which extension I claim as a new and useful improvement on all clasps or bands used for coupling hose, with which I am acquainted."

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18. For an *Improvement in Horse Powers;* M. H. Cornell, Feasterville, Pennsylvania, February 10.

Claim.—"Having thus described my improved horse power, what I claim therein as especially new is, the method of regulating the motion by means of a brake worked by a governor constructed substantially as herein described, so as to operate the brake with a force which increases with the velocity of the machine, until the motion is checked, and then instantly release the brake, so that no unnecessary labor may be imposed upon the animals, when working at the proper speed."

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19. For an *Improvement in Mills for Grinding Quartz;* Smith Cram, City of New York, February 10.

"My quartz crusher and grinder consists mainly of a horizontal annular trough, and of two vertical crushing wheels, which are caused to rotate in the trough, and at the same time to revolve around a central axis."

Claim.—"What I claim as my invention is, the crushing and grinding mill herein described, consisting of a trough and one or more rotating wheels, the acting surfaces of both the wheels and trough being formed as herein set forth, so that the former will run in the latter, without tendency to run over its edges, except as it may be influenced by centrifugal force.

"I also claim the combination of a double ridged wheel rim with a trough of corresponding form, whereby the lumps of quartz, or other substance being ground, are grasped by the wheel in its rolling between the angular groove or furrow contained between the two ridges, and being thus prevented from escaping laterally, are crushed upon the ridge of the trough with much less force and greater effect than if the angular action of the ridges was counteracted by the embedding of the lumps to be crushed, among smaller granular and pulverized particles, which is always the case when the concave or inner angle is below, and the convex or outer angle above, which is the converse of the combination to which this claim refers.

"I likewise claim the method of constructing the wheels of a crushing and grinding mill, of removable sections, substantially in the manner and for the purpose herein set forth."

20. For an *Improved Mode of Preventing Collisions on Railroads;* Thomas A. Davies, City of New York, February 10.

"The nature of my invention consists in applying to a locomotive engine, a sound gatherer with an ear piece, in such a manner that any extraordinary noise made by the approach of a train, or by a steam whistle, or any known way of making a great noise, is gathered and communicated to the ear of the engineer, in time to stop his engine, or train, as the case may be."

Claim.—"What I claim as new and original is, the application of a sound gatherer with an ear piece, to a locomotive engine, or train of cars, arranged substantially as above described, so that the engineer or another can ascertain by sound, the approach of a locomotive or train, in time to prevent collision."

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21. For an *Improvement in Grain Harvesters;* Byron Densmore, Sweden, New York, February 10.

"My invention and improvements consist in a new arrangement for raking the grain from the machine; likewise in a new arrangement for raising and lowering the machine, to vary the height of cut; also in a new mode of hanging the sickle."

Claim.—"What I claim as my invention is, 1st, the combination of the grooved cam (M,) and reciprocating lever K^1, so arranged with each other as to give the rake, while in the act of clearing the platform of grain, an increased rapidity of motion, as compared with its backward movement.

"2d, Controlling the motion of the rake by means of the combined action of the hand (I,) ratchet (*i*,) and lever R as set forth.

"3d, The arrangement of the double eccentric (U,) for equalizing the power of the spring (*m*,) on the lever K, in the manner described.

"4th, Forming supports for the vibrating blade, or sickle, by the plates (*f, f, f,*) in sections separate from the fingers, to prevent choking, as described and represented."

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22. For an *Improvement in Shovel Ploughs;* James H. Forman, Sharon, Alabama, February 10.

Claim.—"What I claim is, the use of the fulcrum pin *d*, and adjusting arrangement of the pin e^2, in combination with the beam and stock of a plough, for the purpose of regulating the dip of the ploughshare, substantially as set forth."

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23. For an *Improvement in Railroad Switches;* Amos Hodge, Adams, Massachusetts, February 10.

Claim.—"I claim the system of levers, lock bolt, and springs, arranged substantially as herein described, in such manner that the switches are always locked securely in the proper position for the direct passage of a train along the main track, unless intentionally unlocked and shifted, as described, and when shifted, are automatically returned to their position in the line of the main track, and locked there, as soon as the force by which they were shifted is withdrawn.

"In combination with the above, I claim the system of jointed levers, wedge blocks, sliding bars, dogs, dog lever, and hook ended bar, or their equivalents, acting substantially as herein described, in such manner that the switch is shifted automatically, to permit a train to pass from a branch to the main track, and is maintained in such position, until the last car has passed off it, when it returns automatically, to restore the continuity of the main track."

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24. For an *Improvement in Portable Shower Baths;* Ferdinand Holm, Brooklyn, New York, February 10.

"The nature of my invention consists in the combination of a force pump, with a box of an octagonal or other suitable form, and jointed together at the middle, so as when closed to form a semi-octagonal box, to hold the force pump, jets, etc.; also in combining with the box or bath tub when opened, a series of leaves, to extend the area of the tub by means of slides, holding the edges of the leaves together, in one continuous rim, to prevent the spray from the jets wetting the floor."

Claim.—"What I claim, therefore, is, the use of the box or tub, for a portable shower bath, made in two halves, in combination with the slide C, leaves D, D, &c., and slides G, G, &c., substantially as set forth."

25. For an *Improvement in Grass Harvesters;* William F. Ketchum, Buffalo, New York, February 10.

Claim.—"Having thus fully described my improvement, what I claim therein as new is, 1st, sustaining the rack piece D, in the manner set forth, by projecting a beam C, from the frame above the grass and behind it, to which it is connected by the rods E, as herein fully set forth; and in combination therewith, I claim the shield plate G, in connexion with the beam C, for sustaining the rack piece D, substantially in the manner and for the purpose above described."

26. For an *Improvement in Apparatus for Regulating and Measuring the Flow of Gas;* Wm. B. Leonard, City of New York, February 10.

Claim.—"I do not claim the indicating apparatus for showing the quantity of gas or fluid consumed in a given time; nor do I confine myself to the use of any particular mode of indicating it, as it may be performed in various ways; neither do I confine myself to the peculiar form of clock movement or mechanism for giving motion to the disk F; but what I do claim is, 1st, the employment, for the purpose of registering the flow of gases and fluids through an aperture, of a disk F, receiving a constant rotary motion, at an uniform speed, and giving motion to a wheel J, in connexion with the indicating apparatus and the cock B, or its equivalent, in the manner herein described, to wit: the wheel J being moved farther from or nearer to the centre of the disk, as the cock is opened or closed, so as to govern the speed of the wheel, and consequently, the indicators, according to the area of the passage through which the gases or fluids are passing.

"2d, The manner of stopping the clock movement, when the cock or faucet is shut by the arm *q*, on the spindle, *o*, being operated by the wheel J, and the lever *p*, substantially as herein shown.

"3d, The manner of closing the valve D, and shutting off the gas or fluid, when the clock is run down, by an arm S, on a spindle *r*, operated by a spring *t*, and held back by a lever U, stopped by suitables catches, and released by the unwinding of the main spring, substantially in the manner herein specified."

27. For an *Improvement in Governors;* Ephraim Morris, City of New York, February 10.

Claim.—"What I claim as new is, an incline or inclines between a hub and cylinder on a shaft, in combination with a resisting spring, or its equivalent, whereby the motion of the parts due to the compression of the spring or its equivalent by the inclines, produces motion to regulate the power, in proportion to the resistance, as described."

28. For *Improvements in a Quartz Crusher;* James H. Swett, Boston, Massachusetts, February 10.

"The nature of my invention consists in arranging a metallic cylinder, which may be round or many sided, into which the material to be operated upon is placed, and which has a rotary motion in one direction; and passing through said cylinder, a shaft, carrying any suitable number of curved arms, which have a rotary motion in a direction contrary to that of the cylinder, and which catch up, carry, and throw over a series of metallic balls, by which the material to be ground or crushed is operated upon."

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, in combination with a cylinder containing the quartz, &c., and rotating in one direction, for the purpose of loosening up the material to be ground or crushed, the curved arms arranged upon a shaft therein, rotating in a contrary direction, for the purpose of catching, carrying up, and throwing over the balls by which said material is ground or crushed; the whole being arranged and combined in the manner and for the purpose herein fully set forth."

29. For an *Improvement in Seed Planters;* Edward Wicks, Bart, Pennsylvania, February 10.

"My invention consists in so constructing the several distributing wheels, with movable

adjuncts or slides, through which the supply is received by the wheels, as that any lateral motion or play of the carrying shaft will not be attendant with the usual friction, or impeding contact, that the distributing wheels now are subject to upon the sides of the apertures through which the grain is fed."

Claim.—"I do not claim exclusively causing the distributing wheel (constructed with cogs or teeth as described) to enter the body of the hopper, as such has already been done: but what I do claim as my invention is, the employment of a slide D, or its equivalent, through which the distributing wheel works, and that, by being movable, operates to avoid friction of the wheel upon the sides of the aperture, (communicating with the hopper,) as liable to be produced by the play of the shaft upon which the distributing wheel, C, is hung, essentially as herein represented and specified."

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30. For an *Improvement in Processes for Dissolving Gold;* Charles F. Spieker, City of New York, February 10; ante-dated August 10, 1851.

Claim.—"What I claim now as my invention is, the separating of gold from its ores, sands, or mixtures, in suitable apparatus, by the use of free chlorine gas, when absorbed by water alone, or by water in combination with an alkali, or an alkaline, earthy, or metallic chloride, containing an excess of chlorine, as set forth in the specification."

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31. For an *Improvement in Railroad Car Brakes;* Birdsill Holly, Assignor to S. Hewit, E. S. Latham, B. Holly, and A. Downs, Seneca Falls, New York, February 10.

Claim.—"What I claim as my invention is, the fixed and sliding rubbers upon the adjacent axle of a railroad car, in combination with the intermediate cog wheels; the whole arranged and operating substantially as herein set forth."

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32. For an *Improvement in Excavating and Dredging Machines;* Calvin Willey, Jr., Chicago, Assignor to C. Willey, Jr., and Urial Walker, Babcock's Grove, Illinois, February 10.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new is, 1st, so arranging the frame upon which the endless chains carrying the ploughs and buckets are supported and carried, as to allow said ploughs and buckets to work outside of the line of said frame, and thereby to sink to any desired depth, without liability of the frame resting upon the bank to be removed, and limiting the depth to which the cutters may sink, as herein described.

"2d, I claim so connecting the machinery for raising and lowering the frames carrying the ploughs and buckets, with the driving power of the machine, that the buckets may be lowered automatically, in such proportion to the motions of the other parts of the machine, as the character of the bottom to be excavated may demand, in manner and for the purpose substantially as described."

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33. For an *Improvement in the Construction of Grate Bars for Furnaces;* Francis Armstrong, New Orleans, Louisiana, February 17; ante-dated August 17, 1851.

Claim.—"What I claim as new and of my invention is, the form and construction of the grate bars for furnaces having jogs, *a*, in the blade of the bar, A, extending from the lower line or edge of the bar, up to the level of the lower line, C, of the extension, through the fire front, thereby securing the advantage of having said grate bars held permanently in their required position, by the said jogs touching each other, and at the same time leaving all that section of the openings above the jogs, free for the admission of a poker between the bars, to remove any solid matter produced from the combustion of the fuel."

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34. For an *Improvement in Pumps;* Abel Barker, Honesdale, Pennsylvania, February 17.

Claim.—"What I claim as my invention is, the combination and arrangement of the two barrels, A and B, and the pistons, E and F, in such a manner that the water shall flow down through the lower barrel, and up through the upper barrel, thereby enabling

one piston to act in descending, and the other in ascending, for the purpose of producing a constant flow of water, substantially in the manner herein described.

"I also claim the peculiar construction of the lower piston, F, by which its valve allows the water to pass downward, and closes by its own weight, either with or without magnetizing, substantially in the manner and for the purpose herein described."

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35. For an *Improvement in Explosive Compositions for Blasting Rocks;* Edward Callow, London, England, February 17; patented in England, August 6, 1850.

Claim.—"What I claim as my invention is, the explosive compound herein described; but I would have it understood, that some of the materials mentioned as component parts in my improved explosive compound, have been used before by pyrotechnists and others, in the manufacture of various fire-works; and that as regards such use, I do not claim any thing in my invention, except so far as regards the combination I have given, and for the purposes also mentioned.

"The shape and material of the cartridge cases have nothing to do with my invention, they being optional with the party using them. I have only given drawings of, and described what I have found to be the most convenient for the purpose."

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36. For an *Improvement in Fences;* John Card, Gainesville, New York, February 17.

Claim.—"What I claim as my invention is, the construction of the posts in pairs, and their combination with the rails, in such a manner as to render the fence strong and firm, by balancing the weight of the fence, by its construction as herein above described, upon each side equally of the centre of each pair of posts, and securing at the same time the advantages of a straight fence, and of posts standing upon the surface, and secured from decay.

"I do not claim as my invention the construction of the posts as herein above described, either singly or in pairs; but the combination of the advantages above mentioned, as substantially described in this specification, and as above claimed by me."

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37. For *Improvements in Railroad Gates;* Egbert P. Carter, Yorkshire, New York, February 17.

"The nature of my invention consists in so constructing rail gates, to be opened and held open by the action of the cars in passing, as that the gate shall swing upward in the arc of a circle, from an axis in the centre of the hub of the gate, by means of a shaft, which the passing train first rotates and then holds fixed, thus avoiding the necessity of having any portion of the apparatus to sink below the level of the track, which is liable to become inoperative by snow, ice, &c."

Claim.—"Having thus fully described my invention, what I claim therein as new is, the method herein described for balancing a railroad or other gate, viz: by means of a spring, coiled around a stationary axis, to which it is attached by one end, the other end being attached to the disk which forms the hub or centre of the gate turning on said axis, substantially as herein described.

"I also claim the use of the rock shaft, provided with the cam ledges and straight ledge, to be operated upon by the wheels of the passing train, and the cams for winding up the chains which draw up the gates; the whole being arranged in the manner and for the purpose herein substantially set forth and shown."

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38. For *Improvements in Machinery for Making Chains;* John M. Crawford, New Castle, Pennsylvania, February 17.

"The nature of my improvement consists in a certain new and useful combination and arrangement of mechanical devices, which operate successively upon the wire or rod, (previously heated to a welding heat,) cutting a piece therefrom of the proper length to form the link, bending the same to a semi-oval or U shape, lapping the ends and welding them together; and thus form the link, and deliver it upon a vibrating suspending arm, on which it is turned, and carried to a seat, from which (seat) it is displaced by the formation of the succeeding link; there being required during the operation of the machine, but one attendant to feed the wire or rod in the machine."

Claim.—"Having thus described the construction and operation of my machine for

making chain, I wish it to be understood, that I do not claim to be the original inventor of "the combination of the parts, movements, and operations, in one machine, which are required to make jack chains by one process from straight wire, after it is cut off in suitable lengths, to the finished chain;" nor do I claim "the stud pin with a recess in it, as a mandrel, around which the bow of a link is bent, while the bow of another link is held in the recess, thereby forming a continuous chain;" nor do I claim a partly revolving mandrel, with a stud pin and nipper, and other appendages, for bending the last bow of each link, as combined, used, and constituting part of a machine" already patented.

"But what I do claim as new and of my own invention is, 1st, The combination of the welding dies, R R^1, with the swage N, for welding or uniting the lapped ends of the link, and dropping the latter upon the suspending arm, S^1, the advance of the die, R, moving the link to the face of the swage, where the operation of welding is performed.

"2d, Attaching the vibrating arm, S^1, to the bed, w^2, of the die, R^1, and operating the same in such manner as to receive the finished link, and suspend the same in a position to be seated.

"3d, The combination of the slide bar, V, turning lever, W, and cross bar, g^2, constructed and arranged as described and represented; the said bar, V, and lever, W, operating to turn and push the finished link into its seat.

"4th, The link seat, O, attached to the lever, *j*, beneath the swage, N, for receiving the finished link from the suspending arm, S^1, and holding the same until the wire or rod for the succeeding link is fed into the finished link, cut off, bent, and ready to be welded.

"5th, The employment of the curved holding lever, Z, attached to the lever, *j*, in combination with the pendant cam bars, 4 and 5, short pendant arm, 9, arm, Y, pin, 3, and spring bar, X, constructed, arranged, and operating as described; whereby the finished link is held in its seat and liberated therefrom simultaneously with the advance of the die, R, to finish the succeeding link.

"6th, The combination of the spring bar, X, with the shear cutter, L, whereby the pendant cam bars, 4 and 5, are attached, through the pin, 3, and springs, 8 8, to hold or relieve the arm, Z, from the seated link, as described and shown in the drawings.

"Finally, I claim making the grooves, *b* b^1, in the bed dies, J J^1, slightly oblique to their faces, for the purpose of canting the ends of the rod or wire, so as to allow them to lap, when bent by the levers, P P, as described."

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39. For an *Improvement in Bran Dusters;* Lewis Fagin, Cincinnati, Ohio, February 17.

Claim.—"Having thus fully, clearly, and exactly described the nature, construction, and operation of my improvements in the flour bolting and bran dusting machine, what I claim therein as new are, 1st, The arrangement of the vanes in the blast cylinder, substantially as described in the specification and illustrated by the diagram, fig. 6, whereby I attain a free escape for the blast, and effectually prevent the accumulation of flour within the blast cylinder, and thus keep the cylinder truly balanced on its shaft or axis.

"2d, The insertion of vertical rows of beaters on each rib of the bolting cylinder, and on the vanes (No. 2) of the blast cylinder, from top to bottom, for the purpose of beating the offal at each successive rib and vane, and preparatory to each jet of blast, substantially as described."

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40. For an *Improvement in Bran Dusters;* Abel Hildreth, Newark, Ohio, February 17.

Claim.—"What I claim as my invention is, the arrangement and combination of the several parts of a bolt or bran duster, in such manner that the draft generated by the rotation of the beaters within the bolting screen shall act as a conveyor or elevator, for the purpose of transferring the bran or meal from any portion of the mill to the bolting or dusting apparatus, and shall at the same time cool the bran or meal thus conveyed.

"I also claim the scouring apparatus herein described, consisting of a series of pairs of toothed disks, arranged in vertical order above each other, at such distances apart as will admit of the free passage of the meal or bran between them, alternately from the centre to the periphery between the disks of each pair, and from the periphery to the centre between the pairs of disks.

"I likewise claim the method herein described, of shielding the current of mixed air and meal or bran from the centrifugal action of the revolving disks, by means of stationary diaphragms, arranged as herein set forth."

41. For *Improvements in Stop Motions of Looms;* Lora B. Hoit, Millbury, Massachusetts, February 17.

"The nature of my invention consists in providing a spring, which is acted upon by the lathe, or a screw in it, to traverse a slide, and cause the belt that propels the loom to be thrown upon the loose pulley, and stop the loom when the weft breaks or runs out; thereby dispensing with the lever, cam, and stud upon which the lever vibrated; and in applying a spring or its equivalent, to act upon the prongs of the lever, which has a catch upon it, so as to raise said catch when the shuttle is in the box at the opposite end of the lathe."

Claim.—"What I claim as my invention is, 1st, The forked lever, *g*, and spring, *m*, constructed and arranged substantially as herein described, in combination with the grid, (or pins, *i i i*,) and slide, *b*, to release the slide when the weft is properly drawn across the grid; and to traverse it, to stop the loom when the shuttle ceases to draw the weft across said grid.

"2d, Is the spring, *q*, or its equivalent, to stop the prongs of the lever, *g*, and raise the catch, *n*, so as not to stop the loom when the shuttle is in the box at the opposite end; the parts being arranged substantially as herein described."

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42. For a *Meter for Steam Boilers;* William H. Lindsay, City of New York, February 17.

Claim.—"I do not claim the special use of a plunger, piston, or pistons, poppet valves, or well known cocks, the same being long known and used: but what I do claim as my invention, as constituting a new and useful improvement in the construction and operation of a fluid meter, is, the means herein set forth, for maintaining the feed to the boiler, &c., and the closing or cutting off the communication to and from the meter, in case of accident, or from other causes, arranged and operating for the purpose and with the intent substantially as described."

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43. For an *Improvement in Steam Boilers;* James Millholland, Reading, Pennsylvania, February 17.

"The object of my invention is to protect the fire-box from over heating, and at the same time to insure the most thorough and complete combustion of the coal burnt therein."

Claim.—"Having thus described my improvements in locomotive's boilers, what I claim therein as new is, the contracted grate in the fire-box, in combination with a supplementary chamber of combustion, supplied with air, and situated at a point intermediate between the fire-box and smoke-box, which is connected with the former and the latter by flues, in the manner substantially as herein described."

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44. For an *Improvement in Grain and Grass Harvesters;* Robert T. Osgood, Orland, Maine, February 17.

Claim.—"What I claim as my invention is, the manner of placing the toggle joint purchase, fig. 4, (with the transverse acting joint, V,) upon the end of the cutter arm, fig. 3, to act in conjunction with the other machinery, giving it as it were a double purchase, by hanging the sweep so that the arm of the crank will be horizontal or parallel with the toggle joint when straight, and giving the cutters its double motion, by acting above and below this line. When the crank or hand, *o*, is up, the purchase is at the upper end of the sweep; when half way down, it is at the lower end or joint, varying like a circular or screw power."

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45. For an *Improvement in the Feeding Apparatus for a Grain Thresher;* William R. Palmer, Elizabeth City, North Carolina, February 17.

Claim.—"What I claim as my invention is, the method herein described of preventing accidents to the feeder of a threshing machine, by interposing between him and the cylinder a roller, or the equivalent thereof, which is arranged across the throat of the machine, and is supported and guided substantially in the manner and for the purposes herein set forth."

46. For an *Improvement in Banding Pullies;* Robert W. Parker, Roxbury, Massachusetts, February 17.

"The nature of my invention consists in driving circular saws or other machinery by a peculiar arrangement of a belt and pullies, by which the main driving pulley is made to pinch the band at the points in the intermediate pullies with any desired force; much of the friction attendant upon the ordinary mode of driving saws and other machinery is dispensed with, the arrangement is more economical, and it is more simple, and a greater effect with the same expedition of the power is obtained."

Claim.—"Having thus described the nature and operation of my invention, what I claim as new is, arranging the driving pulley, B, in reference to pullies, E and F, that the band passing over these pullies is not only pressed, with any desired force, against the periphery of the driver, B, but is also pinched between the pullies, B E, and B F, they operating upon the band as feed rollers, substantially in the manner herein described."

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47. For *Improvements in Capstans;* Peter Roberts, City of New York, February 17.

"The nature of my invention consists of a new combination of mechanical elements, arranged within the base of a machine, known by the following names, viz: capstan, windlass, or heaver, as commonly used on shipboard; the object of which arrangement is the continuous winding motion of that part called the head, (upon which the rope or chain is wound,) while the levers or heavers are caused to move alternately backwards and forwards."

Claim.—"What I claim as my invention is, the combination of the following mechanical elements, viz: the vibrating tumblers acted upon by handspikes; the slide, D, with its racks; the cog wheels, P and Q, the former formed also with ratchet teeth; the ratchet wheel, G, and its hollow shaft; the pawls, M and N; the whole arranged within the base, B, and with respect to each other, and acting substantially as described."

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48. For an *Improvement in Rotary Cultivators;* Pleasant E. Royse, New Albany, Indiana, February 17.

"The chief point of my invention consists in a peculiar construction of the chisel bevel cogs on the driving wheels, for taking and maintaining a firm hold of the ground, the character of which will be apparent."

Claim.—"I am aware that most of the parts contained in this description of my improved machine are not in themselves, separately considered, novel; but that they have, singly or more or less connectively, in similar machines, or others for a different purpose, been employed, patented, or used; such as the front running wheel, D, in ploughs and cultivators driving wheels, A A, having spurs, in various locomotive machines, chain belts and wheels, for communicating motion, revolving shares in harrowing machines; also, in harvesting and other machines, the curved slots and specified appliances, for raising and lowering the shaft, without affecting the stretch of the belt or belts.

"I therefore do not claim as new any of these parts, separately considered, or irrespective of the manner or form, in which I propose in combination to apply them for the purposes and to produce the advantages specified.

"But what I do claim as my invention is, the construction of the teeth on the main or driving wheels of a chisel-formed bevel; that is to say, one face being a continuation of the line or plane of the radius of said wheel, while the other face is beveled, to meet it at an angle somewhat less than forty-five degrees, for the purpose of striking into and taking a firm hold of the ground, in the manner and for the purpose set forth."

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49. For an *Improvement in Weighing Machines;* William and Thomas Schnebly, City of New York, February 17.

Claim.—"What we claim as our invention is, the employment of the method or methods of securing the lever or levers connected with the platform by means of a stop or brake, to hold the platform substantially as described, when this is combined with the pendulous scale or balance, and the apparatus for registering the extent of motion of the said pendulous scale or balance, substantially as specified; by means of which combination we are enabled to register accurately the weight of bodies that roll or slide, or are thrown on

to the platform, and prevent the apparatus from registering, in addition to the actual weight, the momentum of the descending weight of the body to be weighed.

"And we also claim the employment of the mechanism which registers the number of weighings, substantially as specified, when this is combined with the pendulous balance or its equivalent, and its register for registering the sum of the weights weighed by the pendulous balance, substantially as described, whereby an accurate register is kept, not only of the number of articles which have been weighed, but also of the whole weight of what has been weighed, as it is often important to ascertain not only the sum of the things weighed, but also the number of articles which make up that sum."

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50. For an *Improvement in Spoons for Administering Medicines;* J. C. Taylor, West Liberty, Ohio, February 17.

Claim.—"What I claim as my invention is, the particular construction of my spoon with a sliding bottom, and a piston slide, exactly fitting the cavity of the spoon, and the sliding rod, so arranged that it may be slid in at the same moment that the slide tongue or bottom is drawn out, thereby quickly emptying the spoon of its contents.

"I do not claim that my spoon should be a graduating or measuring spoon, but merely for administering medicines already graduated by a physician.

"I claim also, that my spoon will secure, from its arrangement, the advantage of preserving the teeth, and administering all the medicines graduated by the physician, a difficulty often experienced in treating children."

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51. For *Improvements in Knitting Machines;* Timothy Bailey, Ballston Spa, New York, February 24.

Claim.—"What I claim as my invention is, 1st, Releasing the hanging plates, *k*, from the lever, Q^1, by the inclined projections, 5, as they are drawn up, so as to let the uprights, *m*, and lever, U, raise the locking bar.

"2d, The combination of the catch, *n*, (fastened to the upright, *m*,) spring, V^2, lever, U, operated by the groove, E, in the curve, to raise the locking bar, so as to allow the slur to operate and depress the sinkers, to divide the loops and form the stitches; and to raise the lever, Q^1, so as to be caught by the lip, 4, upon the plate, *k*, to lock down the locking bar."

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52. For an *Improvement in Cast Iron Car Wheels;* Albert G. Bristol and Joel C. Jackson, Rochester, New York, February 24.

Claim.—"What we claim as our invention is, the making of car wheels with double plates, extending from the hub to the tread; the plate forming the face of the wheel to be slightly curved backwards, so that a section of it through the centre shall present a very flat arch, whose extremities abut against the rim of the wheel; the back plate, as it spreads from the hub, to be curved in the same direction as the front plate, but as it approaches the tread to be gradually depressed at equal intervals, till it meets the front plate; to be thus thrown into a fold or plait, forming two walls of a triangular cavity, of which the third side is made by the face plate, and in this form to be continued till it meets and unites with the tread; the whole to be in the manner and form substantially as shown in the accompanying drawings."

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53. For a *Duplex Eccentric Valve Motion;* John J. G. Collins, Chester, Pennsylvania, February 24.

Claim.—"What I claim is, the employment of cogs on or to eccentrics wheels, for giving motion to eccentrics or their equivalents, on a second motion, in combination with the guard or framing attached to the clips or straps of the driving eccentric, and so formed and arranged as to unite both vibrating motions derived from the driving and driven eccentrics into one motion, for working the slide and other valves of steam engines, in the manner and for the purpose as specified."

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54. For an *Improvement in Straw Cutters;* Absalom B. Earle, Oneonta, New York, February 24.

Claim.—"What I claim in the foregoing as new is, the method of cutting vegetable substances, by a combined chopping or percussive and shearing cut, produced by means

of stationary knives at the mouths of the feeding troughs, moving knives carried on an oscillating lever and revolving tappets, which actuate the oscillating lever as described."

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55. For an *Improvement in Endless Chain Horse Powers;* Horace L. Emery, Albany, New York, February 24.

Claim.—"Having thus fully explained my improvement and its purposes, what I claim as new is, the manner of constructing the converge gears, pinions, and pullies of the endless chain horse power, with their outer sides concave at their centres, sufficiently to receive their fastenings within the plane of the inner side of the arms, spokes, or faces of such of the gears and pullies, which, when confined upon one shaft, and overreach the other shaft, may pass both shaft and fastening freely; the faces of the several couplings or shoulders upon the shafts, as also the ends of the shafts themselves, being in the same planes, and all the fittings and fastenings of the shafts, gears, and pullies agreeing with each other, for the purpose and in the manner substantially as described."

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56. For an *Improvement in Vessels for Making Ink;* Alexander Harrison, Philadelphia, Pennsylvania, February 24.

"The nature of my improvement consists in arranging a number of reservoirs or vessels in succession, and so connecting them together, that the fluid from the top of the first shall be discharged into the second vessel near its bottom, the fluid from the top of the second into the third reservoir near its bottom, and so on, thus exposing the entire quantity of ink to the oxygenating action of the atmosphere in each vessel successively, and at the same time drawing off from each cask into the successive one, only the purer portions of its contents."

Claim.—"What I claim as my invention is, the arrangement and connecting together a series of vessels for manufacturing ink, in the manner and for the purposes herein set forth."

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57. For an *Improvement in the Manufacture of Zinc White;* Samuel T. Jones, City of New York, February 24.

Claim.—"What I claim as my invention is, the use of a porous or fibrous bag, or receiving chamber, with porous sides or bottom, or an air-tight chamber, with a straining or porous bag adapted to the inside thereof, and used in connexion either with a blowing or exhausting apparatus, so that the products of the distillation and oxygenation of zinc, or other volatile metals, may be separated from the accompanying air and gases, which latter will be forced or otherwise drawn through the pores of the cloth bag or chamber, and escape into the atmosphere."

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58. For an *Improvement in Saw Mills;* Oliver B. Judd, Rockton, New York, February 24.

Claim.—"I do not claim the common carriage, as shown in the annexed drawings; but what I do claim is, simply and substantially raising the tail block as above described, or in any other way substantially the same."

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59. For an *Improvement in Water Wheels;* Joel B. Nott, Guilderland, and William S. Kelly, Princeton, New York, February 24.

Claim.—"We do not claim a water guide, as described in the foregoing specification, composed of a scroll or sections of scrolls, or arcs of circles, or sections of polygons, as concentric with the wheel, to direct the action and impulse of the water upon the concentric wheel, having its guiding surface between parallel planes, as the scroll, and not spiral, as the screw. But what we do claim is, a water wheel composed of a scroll or section of scrolls, or arcs of circles, or sections of polygons, substantially as above described, in combination with a fixed internal guide or guides, made in manner substantially similar to the float or floats of the wheel, but with the direction in reverse, there being sufficient space between the outer extremities of the guide or guides, and the inner extremity of the float or floats, to allow the water to pass between them in all positions; the space between them being substantially on the disk of the wheel, thus causing the driving current of water to

pass between the two, in the direction of the wheel's motion, and act directly upon the inner face of the wheel, propelling the wheel in the same direction with the current; the water being discharged, nevertheless, at the extremity of the scroll, helix, or arcs of circles, or sections of polygons, or either of which the wheel may be composed, in a direction opposite to that in which the wheel revolves."

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60. For *Improvements in Cut-Offs;* Frederick E. Sickels, City of New York, February 24.

"In cut-offs as heretofore constructed, in operating the catch by the closing movement alone, the valve cannot be tripped until sufficient motion had taken place to operate the whole extent of the catch, thus occasioning an unavoidable delay in tripping the valve.

"The nature of my invention, therefore, consists in operating the catch or hold, and liberating the valves of trip cut-offs on the movement to close, or return of the valve motion, by means of an adjustable cam or lever, after it has been partially operated upon, on the opening movement of the valve motion, so as to leave as little movement of the catch, to effect the liberation of the valve, as may be desired to be accomplished by the return movement; thereby being enabled to liberate the valve and cut off the steam, as near the first of the return movement as may be desired."

Claim.—"Having thus fully described my invention, what I claim therein as new is, operating the catch or hold, and liberating the valves of cut-offs, on the movement to close, or return motion of the valve, after it has been partially operated upon in opening, substantially in the manner as herein described, so as to leave as little of the catch to be operated, to effect the liberation of the valve, as may be desired to be accomplished on the return movement; thus being enabled to liberate the valve and cut off the steam, as near the first of the return movement as may be desired."

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61. For an *Improvement in Apparatus for Boring Hubs for Boxes;* Henry Sidle, Dillsburg, Pennsylvania, February 24.

"The nature of my invention consists in providing an auger and box regulator, for the purpose of boring the hubs and regulating the boxes of wagon, carriage, railway cars, and other vehicle wheels."

Claim.—"What I claim as my invention is, the iron shaft in two parts, with the socket and screw in the centre, marked O, so as to increase or diminish the length of said shaft, and also to feed the bitts as described, whereby a hub may be clamped, bored at both ends for the boxes, and removed from the machine, without removing the cutters from the shaft, replacing them, or changing ends of the hub or shaft."

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62. For an *Improvement in Water Gun for Extinguishing Fire;* Hiram Strait, Covington, Kentucky, February 24.

Claim.—"What I claim as of my own invention in the fire gun are, 1st, The combination of the flanch, cap, and guard, constructed and operating in a manner substantially as described.

"2d, Constructing the barrel of the fire gun of successive layers of sheet metal, and casting the breech, trunnion ring, and flanch thereto, in manner substantially as described."

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63. For an *Improvement in Grain Winnowers and Weighers;* Thomas T. Strode Coatesville, Pennsylvania, February 24.

Claim.—"Having thus described my improvement in the combined weighing and winnowing machine, what I claim therein as new is, combining a balance lever weigher with the lower portion of the winnowing machine, whereby the grain, when cleaned, is weighed and removed therefrom, by a portable receiver, as described and represented.

"I also claim constructing the balance lever weigher as represented, and mounting the same upon pivots, or knife-edge bearings, whereby its rearward projecting ends are made to serve as ways or inclined planes, upon which is mounted a portable receiver, so as to balance the weigher, whilst its frontward ends are graduated and furnished with weights by which the number of bushels weighed at each time may be indicated, as described."

64. For an *Improvement in Grain Dryers;* T. E. Weed, Williamsburgh, New York, February 24.

Claim.—"I claim the centre hollow shaft, B B, for the double purpose, first, for forming the support in the centre, for the steam chambers and pans, as described; and, second, for forming a passage for the steam to pass into each of the chambers, for heating the machine.

"2d, I claim, substantially as described, the arrangement of the air chambers I I, between the steam chambers, and pans, with openings in them, for a thin blade of air to escape in a circle from the centre, at a right angle, or nearly so, with the main shaft, B B, and the pipe extending through the machine, as shown, for supplying the chambers with air, operating substantially in the manner and for the purpose as herein set forth."

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65. For an *Improvement in Floating Docks;* Orrillus T. Williams, Smithland, Kentucky, February 24.

Claim.—"Having thus described my dock, and the various uses to which it is applicable, I will state, that I do not claim forcing air into a vessel immersed or partly immersed in water, for the purpose of rendering it buoyant, or of admitting water, for the purpose of allowing it to sink; but what I do claim as my invention is, so forming a cylindric or prismatic dock, as to perform the operation of elevating a vessel above the surface, by combining the buoyancy obtained by injecting air into the cylinders, with the forced revolution of the cylinders on their axis, while lying on the water, substantially as herein set forth.

"2d, I also claim making the rigid submerged elevator in such a manner as to be actuated by compressed air, only so long as to get rid of the contained water, and to be freed from the interior pressure, while sustaining its load above the surface of the water, whereby the liability to accident, from the escape of air under high pressure, is avoided, substantially as herein described.

"3d, I also claim, in combination with a flexible tube for conveying injected air, the use of the revolving pipe directly connected therewith, whereby the pipe may be turned as herein described, for varying the direction of the current of injected air, by turning the flexible tube, as herein set forth.

"4th, I also claim, in combination with the flexible tube for the injection of air, the opening in the bottom of the cylinder, and the vents in its top, whereby the dock is rendered buoyant, while wholly immersed in water and freed from interior pressure, on rising to its maximum height on its surface, substantially as herein set forth.

"5th, I also claim the double parbuckle, c c^1, or analogous turning apparatus, whether a rope or a chain with friction rollers in its links, (fig. 6,) be used for the purpose of turning the opposite elevators (B B^1) in opposite directions, for the purpose of raising the vessel above the water, in the manner substantially as herein set forth."

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66. For an *Improvement in Apparatus for Lightening Vessels;* Orrillus T. Williams, Smithland, Kentucky, February 24.

Claim.—"What I claim as my invention is, the elevator formed by combining jointed frames of inflexible materials, with flexible enclosures made air-tight above and open below, when said jointed frames are so constructed as to attach themselves to the bottom of a vessel, after being let down by its side, and the flexible enclosure so arranged as to admit of the injection and retention of air beneath it, for the purpose of buoying up the vessel, substantially as herein set forth.

"2d, I also claim making jointed elevator frames, in such a manner as to adjust themselves to the form of a vessel's sides, whereby the flexible enclosure for air is allowed to come in close contact with the outside of the vessel, in the manner and for the purposes herein set forth.

"3d, I also claim, in combination with a flexible enclosure for retaining the air, the hook, D, upright or chain, C, brace, B, and stretcher, S, whereby the elevator is made capable of attaching itself to the vessel, and of raising the same without the necessity of passing a support beneath the keel, as herein set forth."

Designs for February, 1852.

1. For a *Design for a Mantel Grate Frame and Summer Piece;* James L. Jackson, City of New York, February 3.

Claim.—"Having thus fully described the nature of my design, what I claim therein as

new is, the combination and arrangement of the figures, flowers, and ornaments herein represented, the whole forming an ornamental design for a mantel grate frame and summer piece."

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2. For a *Design for a Grate Frame and Summer Piece;* James L. Jackson, City of New York, February 3.

Claim.—"Having thus fully described the nature of my design, what I claim therein as new is, the combination and arrangement of the ornamental figures herein represented, and forming an ornamental design for a grate frame and summer piece."

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3. For a *Design for Grate Frames;* James L. Jackson, City of New York, February 3.

Claim.—"Having thus described the nature of my design, what I claim therein as new is, the combination and arrangement of ornamental figures herein represented, and forming an ornamental design for a grate frame."

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4. For a *Design for Grate Frames;* James L. Jackson, City of New York, February 3.

Claim.—"Having thus described the nature of my design, what I claim therein as new is, the combination and arrangement of the ornamental figures herein represented, and forming an ornamental design for a grate frame."

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5. For a *Design for Hair Combs;* James Shields, Fishkill, New York, February 3.

Claim.—"What I claim to be new and original is, the design and configuration of a ladies' hair comb, as described above, and represented in figs. 1 and 2."

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6. For a *Design for Stoves;* Conrad Harris and Paul W. Zoiner, Cincinnati, Ohio, February 10.

Claim.—"What we claim as our invention is, the combination of the scrolls and foliage, arranged as set forth in the annexed drawings, so as to form an ornamental design for coal and wood parlor stoves, to be known and called the Juno Parlor."

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7. For a *Design for Ladies' Hair Combs;* James Blackman and Charles Skidmore, Newtown, Connecticut, February 17.

Claim.—"What I claim as new is, the design, A, composed or formed of a series of ringlets or curls, *a*, said ringlets or curls forming a curve, and placed on the upper part of the back of the comb; the ringlets or curls being in an inclined position, those on one side of the centre of the comb inclining in direction reverse from those on the other side, substantially as herein shown and described."

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8. For a *Design for a Grate Frame and Summer Piece;* James L. Jackson, City of New York, February 17.

Claim.—"Having thus described the nature of my design, what I claim therein as new is, the combination and arrangement of the ornamental figures herein represented, and forming an ornamental design for a grate frame and summer piece."

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9. For a *Design for Stoves;* James Leffel, Springfield, Ohio, February 24.

Claim.—"Having thus described and represented my design for stoves, what I claim therein as new is, the combination of the above ornaments, arranged as described."

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10. For a *Design for Parlor Stoves;* N. S. Vedder and William L. Sanderson, Troy, Assignors to Warren, Swetland & Little, Half Moon Village, New York.

Claim.—"Having thus described our design of stove, what we claim is, the design and configuration of stove, substantially the same as described and represented in the annexed drawings."

LAW REPORTS OF PATENT CASES.

Reported for the Journal of the Franklin Institute.

Circuit Court of the United States, Northern District of New York, Ross Winans vs. the Troy and Schenectady Rail Road Company.

Action at Law for the infringement of Ross Winans's patent for the improvement commonly known as the Eight-wheel Railway Car.
Defences—Want of originality of invention.
Invalidity of patent—No infringement.

This was an action for the infringement of a patent granted to Ross Winans, on the 1st of October, 1834, for an improvement in the construction of cars or carriages intended to run on rail roads. The suit was commenced on the 14th of July, 1847, and was tried at the term of the Circuit Court of the United States, holden at Canandaigua, June, 1850, before Judge Conklin and a jury—Messrs. Spencer, Keller and Blatchford for plaintiff, and Messrs. Stevens and Buel for defendant.

The nature of the improvement patented, is thus set out by the specification of the patent.

"The object of my invention," the patentee says, "is, among other things, to make such an adjustment or arrangement of the wheels and axles as shall cause the body of the car or carriage to pursue a more smooth, even, direct and safe course than it does as cars are ordinarily constructed, both over the curved and straight parts of the road, by the before-mentioned desideratum of combining the advantages of the near and distant coupling of the axles and other means to be further hereinafter described." This is the object of the plaintiff's invention as stated by him. He then goes on to describe the means he has invented to effect the object he has specified.

"For this purpose," says he, "I construct two bearing carriages, each with four wheels, which are to sustain the body of the passenger or other car, by placing one of them at or near each end of it in a way to be presently described. The two wheels on either side of the carriages are to be placed very near to each other, the spaces between their flanches need be no greater than is necessary to prevent their contact with each other. These wheels I connect together by means of a very strong spring—say double the usual strength employed for ordinary cars—the ends of which spring are bolted, or otherwise secured to the upper sides of the boxes, which rest on the journals of the axles; the larger leaves of the springs being placed downwards and surmounted by the shorter leaves. Having thus connected two pairs of wheels together, I unite them into a four wheel bearing carriage, by means of their axles and a bolster of the proper length, extending across, between two pairs of wheels, from the centre of one spring to that of the other, and securely fastened to the tops of them. This bolster must be of sufficient strength to bear a load upon its centre of four or five tons. Upon this first bolster I place another of equal strength, and connect the two together by a

centre pin or bolt passing down through them, and thus allowing them to swivel or turn upon each other, in the manner of the front bolsters of a common road wagon. I prefer making these bolsters of wrought or cast iron; wood, however, may be used. I prepare each of the bearing carriages in precisely the same way. The body of the passenger or other car, I make of double the ordinary length of those which run on four wheels, and capable of carrying double their load. This body I place so as to rest its whole weight upon the two upper bolsters of the two before mentioned bearing carriages or running gear. I sometimes place these bolsters so far within the ends of the body of the car, as to bring all the wheels under it; and in this case, less strength is necessary in the car body, than when the bolster is situated at its extreme ends. In some cases, however, I place the bolster so far without the body of the car, at either end, as to allow the latter to hang down between the two sets of wheels or bearing carriages, and to run, if desired, within a foot of the rails."

He then goes on to speak of some particular features of this invention, and finally he states explicitly, in a summary at the end of the specification, what he claims, and what he does not claim, as follows:—"I do not claim, as my invention, the running of cars or carriages, upon eight wheels, this having been previously done; not, however, in the manner or for the purposes herein described, but merely with a view of distributing the weight carried, more evenly upon a rail or other road, and for objects distinct in character from those which I have had in view, as herein before set forth. Nor have the wheels, when thus increased in number, been so arranged and connected with each other either by design or accident, as to accomplish this purpose. What I claim, therefore, as my invention, and for which I ask a Patent, is the before described manner of arranging and connecting the eight wheels, which constitute the two bearing carriages with a rail road car, so as to accomplish the end proposed by the means set forth, or by others which are analogous and dependent upon the same principles."

The defendant denied that Ross Winans was the original inventor of the improvement thus described and claimed. He contended that the description given of the invention, was not sufficiently full and clear to enable others to use it—that he had abandoned his invention before obtaining a patent; and lastly, that the defendant's cars were no infringement of the patent. The defendant introduced the testimony of a number of witnesses in support of these positions, and the plaintiff introduced a number of witnesses to rebut this testimony. Judge Conkling reviewed all the points raised, in an elaborate charge to the jury.

After concluding his charge, his Honor, Judge Conkling, in answer to several prayers for instructions, offered by the defendant's counsel, instructed the jury in substance as follows:

That it was undoubtedly true that a patent could not be taken merely for a purpose, end or object, but that he doubted the pertinency of any instruction on that point in this case; because the patent here was not for a purpose, but for the means of effecting a purpose.

That the specification was sufficient, if the patentee had described a carriage susceptible of an attachment of the power to the body, and if

the drawing showed such mode of attachment, and that the plaintiff suffered no disadvantage from not stating it in his written specification, and although the drawing was not to be taken into consideration for the purpose of measuring the extent of the claim, yet it might be considered in ascertaining whether what he claimed was new.

That the patent was valid, if the plaintiff's car was substantially, on the whole, a new and useful thing.

That if a thing, substantially like the plaintiff's car had been described, prior to his invention, in some public work that had been produced, then the patent was not good; but that it was not enough that the description should merely suggest the idea of the invention.

That it was a question of fact for the jury, whether the specification was sufficiently exact and intelligible, in reference to the position of the trucks.

That, in order to find for the plaintiff, the jury must be convinced that what the plaintiff had patented is useful; but that any degree of utility was sufficient to support a patent—the word useful, in the patent law, being used in opposition to frivolous or noxious; and that, with regard to the question of side-bearings, although the jury should think it better to have longer bearings than the plaintiff contemplated, that could not take away the utility of his invention, as it was not necessary that the thing patented should be the best possible thing of the kind that could be made.

That if the jury believe that the intermediate time between putting the Columbus into use, and the taking out of his patent, was devoted, by the plaintiff, in good faith, to perfecting of his invention, he cannot be considered as having abandoned it; but that if the invention was perfected in the Columbus, there could be no need of farther experiment.

That, in order to warrant the jury in finding an infringement by the defendants, they must be shown to have used either the same thing, or substantially the same thing, as the plaintiff's invention.

The jury found a verdict in favor of the plaintiff, on both the questions of originality and of infringement.

A motion for a new trial was argued before Judges Nelson and Conkling, at the June term, 1851, of the court, when Judge Nelson delivered the following opinion denying the motion for a new trial:

Nelson, J., I. I have examined the various grounds presented by the counsel for the defendants, on the motion for a new trial, and after the fullest consideration, am of opinion the motion must be denied.

Most of the exceptions taken at the trial, and relied on in the argument here, are founded upon what we regard as an entire misapprehension of the thing claimed to have been discovered by the plaintiff, and for which the patent has been issued. This will be seen on a reference to the instructions prayed for by the defendants, upon which most of the questions in the case arise. They assume that if any material part of the arrangement and combination in the construction of the cars or carriages described in the patent was before known, or in public use, it is invalid; and hence various parts were pointed out by the counsel at the trial, and the court requested to charge that if either of them was not new, the jury should find a verdict for the defendants.

Now, the answer to all this class of exceptions is, that the patentee sets up no claim to the discovery of the separate parts of the arrangement which enter into the construction of his cars. These may be old and well known, when taken separately and detached, for aught that concerns his invention. His claim is for the car itself, constructed and arranged as described in his patent. This, I think, is the clear meaning of the specification, and of the claim as pointed out in it; proving, therefore, that parts of the arrangement and construction were before known, amounted to nothing. The question was whether or not cars or carriages for running on rail roads, as a whole, substantially like the one described in the patent, had been before known or in public use, not whether certain parts were or were not substantially similar.

The argument presupposes that the claim is for the discovery of a new combination and arrangement of certain instruments and materials, by means of which a car is constructed of a given utility; and that if any one or more of the supposed combinations turns out to be old, the patent is invalid. This is the principle upon which much of the defence has been placed; but no such claim is found in the patent; no particular combination or arrangement is pointed out as new, or claimed as such. The novelty of the discovery is placed upon no such ground; on the contrary, the result of the entire arrangement and adjustment of the several parts described, namely, the rail road car, complete and fit for use, is the thing pointed out and claimed as new. This is the view taken by the Chief Justice of the patent, in the case of the present plaintiff, against the "Newcastle and French Town Turnpike and Rail Road Company," tried before him in the Maryland Circuit, and which was adopted by the judge in the trial of this case.

II. It was further insisted on the part of the defendants, that if the relative position of the two bearing carriages to each other, constitutes a material part of the arrangement in the construction of the cars, the patent was void, unless the jury should find that the specification described with sufficient precision the location of these bearing carriages under the body of the car, so as to enable a mechanic of skill in the construction of cars, to place them at the proper distance apart without experiment or invention. It was also contended that the remoteness of the bearing carriages from each other, was not so described in the specification, as to constitute any part of the improvement.

In respect to this branch of the case, the court charged that the relative position of the bearing carriages to each other, in the construction of the car, was a material part of the arrangement of the patentee, and left the question to the jury whether or not he had sufficiently described the position of the trucks, having in view their distance apart, and also from the ends of the car body, suggesting at the same time, that the location must always depend, in a measure, upon the length of the body.

It will be seen on looking into the specification, that the location of the trucks relatively to each other under the body, as well as the near proximity of the two axles of the truck to each other, form a most essential part of the arrangement of the patentee in the construction of his cars.

Great pains have been taken to point out the defects in the existing

four wheel cars; and the impediments to be encountered and overcome in the running of cars upon rail roads, as the latter are usually constructed. The patentee states that in the construction of them, especially when of considerable length, it has been found necessary to admit of lateral curvatures, the radius of which is sometimes but a few hundred feet, and that it becomes important, therefore, to so construct the cars as to enable them to overcome the difficulties presented by these curvatures, and to adapt them for running with the least friction practicable on all parts of the road. The friction referred to, is that which arises between the flanches of the wheel and the rail, causing great loss of power, destruction of the wheels and rails, besides other injuries. For this purpose, he constructs two bearing carriages, each with four wheels, which are to sustain the body of the passenger or other car, by placing one of them at or near each end of it, as particularly described. The two wheels on either side of the truck, are to be placed very near each other—the spaces between the flanches need be no greater than is necessary to prevent their contact with each other. The car body rests upon bolsters supported on each of the two bearing carriages, or four wheel trucks, the bolsters so constructed as to swivel or turn on each other, like the two front bolsters of a common wagon. The body of the car may be made of double the length of the four-wheeled car, and is capable of carrying double its load. The truck may be so placed within the ends of the car as to bring all the wheels under it, or without the end, so as to allow the body to be suspended between the two bearing carriages. The patentee further states that the closeness of the fore and hind wheels of each bearing carriage, taken in connexion with the use of the two bearing carriages, arranged as distant from each other as can conveniently be done for the support of the car body, with a view to the objects and on the principles before set forth, is considered by him as an important feature of the invention; for by the contiguity of the fore and hind wheels of each bearing carriage, while the two bearing carriages may be at any desirable distance apart, the lateral friction from the rubbing of the flanches against the rails is most effectually avoided, while at the same time all the advantages attendant upon placing the axles of a four-wheeled car far apart are obtained.

The two wheels on either side of the bearing carriages may, from their proximity, be considered as acting like a single wheel, and as these two bearing carriages may be placed at any distance from each other, consistent with the required strength of the body of the car, it is apparent that all the advantages are obtained which result from having the two axles of a four-wheeled car at a distance from each other, while its inconveniences are avoided.

Among the principles stated by the patentee to be taken into consideration in the construction of the car is, that the greater the distance between the axles, while the length of the body remains the same, the less the influence of shocks and concussions occurring on the road; and hence the relief from them, when the trucks are placed under the extreme ends of the body, is greater than when placed midway between the centre and the end.

It is apparent from what we have already referred to in the specifica-

tion, and still more manifest on a perusal of the whole of it, that the improvement in this part of the arrangement does not consist in placing the axles of the two trucks at any precise distance apart in the construction of the car, or from each end of the body. The distance used must necessarily depend somewhat upon the length of the car and strength of the materials of which it is built, and hence it was impracticable to specify in feet or inches, the exact distance from the ends of the car body at which it would be best to arrange the trucks. Neither do the advantages of a car constructed and arranged as described, depend upon the trucks being placed at a specified distance from the ends, or so that there may be a specified distance between the axles.

Having in view the defects in the existing cars, and other difficulties to be encountered, some considerable latitude may be allowed in this respect, consistent with the object sought to be attained, to remedy the defects in the existing cars. All the principles for the construction of one, for the purpose of overcoming these difficulties, and remedying these defects, are particularly set forth in the description given by the patentee. We think the specification sufficient, and that the court was right in the opinion expressed on this branch of the case.

Any mechanic of skill could readily arrange the bearing carriages in connexion with the body of the car so as to secure the advantages so minutely and clearly pointed out, and which are shown to attend the practical working of cars constructed in the manner described.

III. The questions of originality and of infringement, were questions of fact, and depending upon the evidence, and were properly submitted to the jury. We think the weight of it decidedly with the verdict.

IV. The patent in this case was originally issued 1st October, 1834, and was recorded anew, 7th of June, 1837, according to the Act of Congress of the 3d of March, 1837, (5 St. at large 191.) No drawings were attached to the original patent, nor was there any reference therein to drawings. On the 25th of September, 1848, the patent was extended for the term of seven years, from the 1st of October, 1848. The plaintiff gave in evidence at the commencement of the trial, a certified copy of the patent and specification, certificate of the extension, drawing with references to the same, and an affidavit of the plaintiff, made November 19, 1838. The drawing was not filed at the time the patent was recorded anew, but was filed on the 19th of November, 1838. The counsel for the defendant objected to the evidence on the grounds, 1st, That it appeared that no drawing was annexed to the original patent, and 2d, That the Act of Congress did not make such a drawing evidence. The court also instructed the jury in summing up the case, that the drawing, a certified copy of which had been given in evidence, was to have the same force and effect as if it had been referred to in the specification, and was to be deemed and taken as part of the specification.

The first section of the Act of 1837, provides that any person interested in a patent issued prior to the 15th of December, 1836, may, without any charge, have the same recorded anew, together with the descriptions, specification of claim and drawings annexed, or belonging to the same; and it is made the duty of the Commissioner to cause the same,

or any authenticated copy of the original record, specification or drawing which he may obtain, to be transcribed and copied into books of record kept for that purpose; *and whenever a drawing was not originally annexed to the patent, and referred to in the specification, any drawing produced as a delineation of the invention, being verified by oath in such manner as the Commissioner shall require, may be transmitted and placed on file, or copied as aforesaid, together with the certificate of the oath, or such drawings may be made in the office under the direction of the Commissioner in conformity with the specification.*

The second section provides that copies of such records and drawings, certified by the Commissioner, or in his absence, by the chief clerk, shall be prima facie evidence of the particulars of the invention and of the patent granted therefor, in any judicial court of the United States, in all cases where copies of the original record, or specification and drawings, would be evidence without proof of the loss of such originals. This section also provides that no patent issued prior to the aforesaid 15th day of December, 1836, shall, after the first day of June, then next, be received in evidence in any court on behalf of the patentee, unless so recorded anew, and a drawing of the invention, if separate from the patent, verified as aforesaid, and deposited in the patent office. See also section third of the same act.

It is quite clear, upon the above provisions of the act, that the court was right in admitting the drawings in connexion with the patent and specification in evidence. The whole together are made prima facie evidence of the particulars of the invention and of the patent granted therefor.

The weight to be given to the drawings furnished under the act by way of enlarging or explaining the description as given in the specification, is another question. That will depend upon the circumstances of each particular case. As a general rule, they will not be effectual to correct any material defect in the specification, unless it should appear that they correspond with one accompanying the original specification for the patent, otherwise, in case of discrepancy between the drawing and specification, the latter should prevail. Care must be taken to avoid imposition by the use of the newly furnished drawing, and for this purpose the specification will afford the proper correction, unless the plaintiff goes further and shows that it conforms to the one originally filed.

The charge that the drawing in this case was to have the same force and effect as if it had been referred to in the specification, and was to be deemed and taken as part of it, was, perhaps, too strong, as it respects the drawings furnished under the act of 1837. The principle is true as it respects those accompanying the original application for the patent, but can hardly be said to be applicable to the full extent stated in the case of these newly furnished drawings. The principle might open the way to imposition and fraud. Assuming that there is nothing but the oath of the party attesting that the drawing affords a true delineation of the invention, the specification should prevail in case of a material discrepancy. But admitting the instruction in this respect not to be strictly correct, and that too much weight was given to the drawing, we do not see that it would have altered the result. The specification

afforded a sufficient description of the invention, independently of the drawing. Some slight additions that improved the working of the car, were open to some question, whether they were embraced in the specification, but they did not enter into the essence of the invention, or constitute any substantial part of the improvement. Time and experience usually indicate these slight additions and alterations, and they should be regarded as consequential results belonging to the inventor. It requires time and experience, usually, to perfect the machine, and improvements derived therefrom, are justly due to him.

V. As to the prior use of the car Columbus, and others constructed by the patentee before he made application for his patent, we think the instruction of the court correct. The law allows the inventor a reasonable time to perfect his invention by experiments; and these could be made in this instance, only by putting the car in the service of those controlling lines of rail roads. There were repeated failures in the experiments tried, and the cars abandoned before the perfection of the car described in the patent. These experiments and trials sufficiently account for the previous use set up by way of forfeiture of the invention.

Upon the whole, after a careful examination of the case, and of all the points made by the defendants on the argument, many of which have been noticed above, we are satisfied that the verdict is right, and that a new trial should be denied.

The defendant then moved for "writ of error" to the Supreme Court of the United States, on written briefs filed by D. Buel, Jr., and S. Stevens, Esqs., for the Company, and J. A. Spencer, Esq., for the plaintiff, which was decided January 24th, 1852, negatively.

Counsel for the plaintiff then moved the Court at its late session, for an injunction to restrain the defendants from further violating his rights, upon which motion the injunction was granted.

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Notes on the U. S. Steamer Vixen. By Chief Engineer, B. F. ISHERWOOD, *United States Navy.*

The *Vixen* was one of two small war steamers precisely alike, originally built for the Mexican Government by Messrs. Brown and Bell of New York. These steamers, in an unfinished state, were, at the commencement of the late war with Mexico, still in the hands of the builders, from whom they were then purchased by the United States, armed, and employed against their original proprietors. At the termination of the war, one of them (the *Spitfire*) was sold, and the other (the *Vixen*) retained in the Navy.

As first constructed, the engine of the *Vixen* was fitted with a piston valve and an independent slide cut-off; but on the return of the vessel at the conclusion of peace, double puppet valves and a cut-off, invented by Chief Engineer, Wm. Sewell, U. S. Navy, were substituted; also, the depth of hold was increased from 9½ to 12 feet, and the main shaft raised one foot.

The results given in these notes, are from the log of the vessel after the above alterations were made.

Two kinds of boilers have been used in the *Vixen*, viz: the original boiler with double return drop flues, and the Montgomery boiler with vertical tubes containing the water inside the tubes and having the heated gases applied externally; the space containing the heated gases being divided vertically in two compartments by a division plate or diaphragm placed about midway the tubes. The results from both boilers will be given separately.

Dimensions of the Vessel and Machinery.

Hull.

Length on deck,	118 feet.
Beam, „	22 " 6 inches.
Depth of hold,	12 " 0 "
Draft of water, deep load (7 ft. 9 in. forward, 7 ft. 11 in. aft,) mean,	7 " 10 "
Draft of water with all coal out, but all other weights in,	6 " 6 "
Mean draft of water for the time steamed,	7 " 2 "
Immersed amidship section at 7 feet 2 inches draft,	147 square feet.
Square feet of immersed amidship section per cubic foot of space displacement of piston,	3·467 "

Rig.—Two masted fore and aft schooner. Under sail alone, the vessel may be considered unmanageable.

Engine.—One half beam horizontal condensing engine, Lighthall's patent.

Diameter of cylinder,	3 feet.
Stroke of piston,	6 "
Space displacement of piston per stroke,	42·408 cubic feet.

Paddle Wheels.

Diameter from outside to outside of paddles,	18 feet 6 inches.
Length of paddle,	6 " 4 "
Breadth of paddle	2 " 0 "
Dip of paddle at 7 feet 2 inches draft of vessel,	2 " 8 "
Number of paddles in each wheel,	14.
Number of paddles in water in each wheel at 7 feet 2 in. draft,	3.
Area of two paddles,	25½ square feet.
Proportion of the area of two paddles to immersed amidship section of hull,	1·000 to 5·802
Proportion of the area of all the immersed paddle surface to immersed amidship section of hull,	1·000 to 1·933

Original Boilers.—Two iron double return drop flue boilers, placed one on each side the engine.

Length of each boiler,	16 feet.
Breadth "	5 " 6 inches.
Height, "	8 " 1 "
Cubic contents of circumscribing parallelopipedon of each boiler,	711½ cubic feet.
Area of the heating surface in the two boilers,	750 square feet.
" grate " "	47 "
Capacity of steam room in boilers,	584 cubic feet.
" " " and steam pipe,	615 "
Cross area of each of the three rows of flues (both boilers),	6·303 sq. feet.
Cross area of the chimney,	6·303 "
Height of chimney above grate,	43 feet 9 inches.
Mean pressure of steam above atmosphere per sq. in. in boilers,	12½ pounds.
Initial " " " cylinder,	10·3 "
Cutting off at, from commencement of stroke of piston,	26½ inches.
Double strokes of piston per minute,	14·23
Consumption of Pittsburg bituminous coal per hour, with natural draft,	564 pounds.

PROPORTIONS.

Proportion of heating to grate surface,	15·958 to 1·000	
" grate surface to cross area of each of the 3 rows of flues,	7·457	"
" " " chimney,	7·457	"
" heating surface to cross area of each of the 3 rows of flues,	118·991	"
" " " chimney,	118·991	"
" heating surface per cubic foot of space displacement of piston,	17·685	sq. feet.
" grate " " " "	1·108	"
" heating surface per cubic foot of space displacement of piston, multiplied by number of double strokes (14·23) per minute,	1·245	"
" grate surface per cubic foot of space displacement of piston, multiplied by number (14·23) of double strokes per minute,	0·078	"
Cubic feet of steam room per cubic foot of steam used per stroke of piston,	31·527	
Consumption of bituminous Pittsburg coal per square foot of grate surface per hour with natural draft,	12	pounds.
Consumption of bituminous Pittsburg coal per square foot of heating surface per hour with natural draft,	0.752	"
Sea water evaporated by one sq. ft. of heating surface per hour,		
" " one pound of Pittsburg bituminous coal per hour,		

These boilers, (Plate II,) under ordinary steaming would furnish steam enough at the above pressure to cut off at half stroke; the piston of course making a proportionally increased number of strokes; the coal is reported as of very inferior quality.

PERFORMANCE WITH THE ORIGINAL BOILERS.

The following results are the mean of 311 hours steaming in the Gulf of Mexico, during the months of February and March, 1851, embracing the usual variety of wind, sea, dip of paddle, and vessel's draft of water. The boilers were six years old, and very foul with incrustation.

Steam pressure in boiler above atmosphere per square inch, $12\frac{1}{2}$ pounds, cutting off at $26\frac{1}{3}$ inches from the commencement of the stroke, giving a mean effective pressure by indicator of 16 pounds per square inch of piston; number of double strokes of piston per minute, 14·23; actual horse power developed by the engine, 86·266.

The speed of the vessel was 6·52 knots of $6082\frac{2}{3}$ feet, or 7·511 statute miles.

The diameter of the circle of the centre of reaction was $17\frac{1}{4}$ feet; the circumference normal to which is 54·19 feet; and

54·19 × 14·23 × 60 = 46267·42 feet = speed of centre of reaction of paddles per hour.
$6082\frac{2}{3}$ × 6·52 = 39658·99 feet = speed of vessel per hour.

6608·43 feet = slip of centre of reaction of paddles per hour.

or, 14·28 per cent.

The oblique action of the paddles, calculated as the squares of the series of their angles of incidence on the water, is 11·94 per cent.

Total losses of effect by the paddle wheels, (14·28+11·94) 26·22 per cent.

The evaporation was obtained as follows: The steam being cut off at $26\frac{1}{3}$ inches from the commencement of the stroke, there was filled per stroke, 15·507 cubic feet of the cylinder, to which must be added 4 cubic

feet comprised between the cut-off valve (which was also the steam valve,) and piston, including clearance, nozzles, &c., making 19·507 cubic feet of steam of the total pressure of 25 pounds per square inch; the initial cylinder pressure being 1.7 pounds less than the boiler pressure. There would consequently be furnished per hour, (19·507×28·46×60) 33349·168 cubic feet of steam of that pressure; and as the relative volumes of steam of the density due to that pressure and water are as 1044 to 1, there would be evaporated (33349·168÷1044) 31·943 cubic feet of water. Taking the cubic foot of sea water at 64·3 pounds, there would be evaporated per hour, by one pound of Pittsburg bituminous coal, $\left(\frac{31{\cdot}943\times64{\cdot}3}{564}\right)$ 3·642 pounds of sea water; to this must be added the loss by *blowing off* at $\frac{2}{3\,2}$ of Sewell's Salinometer, obtained as follows: the total heat of steam being taken at 1202° F., the temperature of the feed water from the hot well at 100° F., the temperature of the steam and water in the boilers at 241° F., and one-half the water pumped in the boilers being blown out; then, 1202°—100°=1102°, the heat used in evaporating the water; and 241°—100=141°, the heat used in *blowing off;* hence, 1102°+141°=1243°, the total heat used and lost, and 141 is 11·34 per cent. of 1243, leaving the complement of 100 per cent., or (100—11·34) 88·66 as the proportion of the total heat evolved from the fuel applied to the evaporation of the water; and as this 88·66 per cent. evaporated 3·642 pounds, 100 per cent. would evaporate 4·107 pounds. The evaporation then by one pound of Pittsburg bituminous coal per hour, would be 4·107 pounds of sea water.

Increasing the total weight of water evaporated, in like manner, by the same per centage for loss by *blowing off*, and we have the total evaporation of 36.029 cubic feet, or 2316·64 pounds of sea water by 750 square feet of heating surface, being 3·089 pounds of sea water per square foot.

The original boilers having become corroded out, a pair of the Montgomery vertical tubular boilers (Plate III,) were substituted in 1851.

Performance with the Montgomery Boilers.

The following performances of the Montgomery boilers are taken from the *Vixen's* steam log, kept during a passage from Pensacola to Key West, Florida. On this passage both Cumberland bituminous and anthracite coals were used. In both cases, the conditions of wind and sea remained sensibly the same; the wind and swell were moderate, and abeam. The boilers being nearly new, were clean and free from incrustation.

The Cumberland bituminous was used for the first half of the passage, and the anthracite for the last half, with natural draft in both cases.

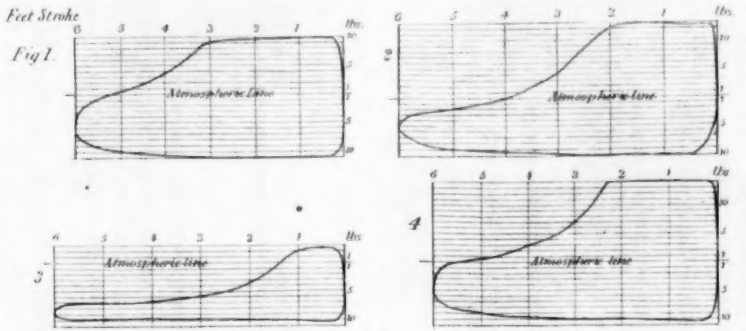
Performance with the Cumberland.

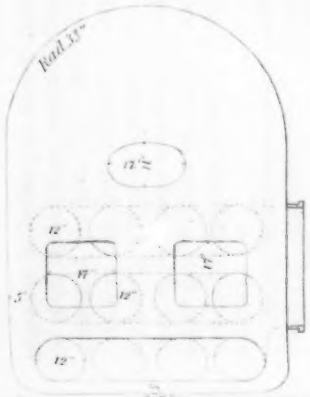
Mean speed of vessel per hour, 6·64 knots; double strokes of piston per minute, 15·675; vacuum in condenser per gauge 26 inches of mercury; steam pressure in boiler per square inch above atmosphere, 14·67 pounds, cut off at 36 inches from commencement of stroke of piston; pounds of coal consumed per hour, 676; sail used half the time.

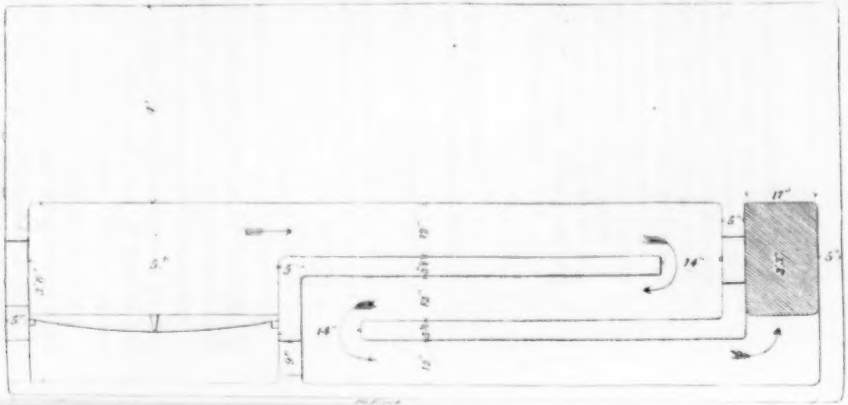
Performance with the Anthracite.

Mean speed of vessel per hour 5·95 knots. Double strokes of piston per minute 14·88; vacuum in condenser per guage 26 in. of mercury. Steam

Original Boilers of the U.S. Steamer VIXEN.







pressure in boiler per square inch above atmosphere 14·75 pounds; cut off at 36 inches from commencement of stroke of piston. Pounds of coal consumed per hour 713. Sail used one-third the time.

It was extremely difficult to keep steam with anthracite after the first 24 hours; with Cumberland coal, steam was kept more easily, but after three or four days continuous steaming with it, the spaces between the tubes would choke up, and so impair the draft as to render it necessary to stop the engines, draw the fires, cool the boiler, and clean out the tube spaces.

During an attempt made to steam from Pensacola to New Orleans with Pittsburg bituminous coal, the tube spaces choked completely up in 24 hours, so as to wholly destroy the draft, the flame rushing out into the fire room whenever the doors were opened, and the vessel put back to Pensacola, reaching port with difficulty.

With these boilers, there is required about an hour and a quarter to raise steam from sea water of Gulf temperature, say 60° F.

Calculating the evaporation by the Cumberland coal in the same manner as before, there results an evaporation of 5·237 pounds of sea water per pound of coal per hour, and 3·248 pounds of sea water per square foot of heating surface per hour.

Proceeding in the same manner with the anthracite, there results an evaporation of 4·713 pounds of sea water per pound of coal per hour, and 2·729 pounds of sea water per square foot of heating surface per hour.

Montgomery Boilers.—Two of iron, placed one on each side the engine.

Length of each boiler,	13 feet 9 inches.
Breadth "	5 " 6 "
Height "	7 " 9 "
Cubic contents of circumscribing parallelopipedon of each boiler,	586·09 cubic feet.
Area of the grate surface in the two boilers,	53·60 square feet.
" heating " "	1090·00 "
Capacity of steam room in boilers,	390·00 cubic feet.
" " " and steam pipes,	425·00 "
Cross area of side flue, both boilers,	7·56 square feet.
" spaces between tubes above division plate or diaphragm (both boilers),	7·64 "
" " " below, " "	7·03 "
" smoke chimney,	8·73 "
Height of smoke chimney above grate,	48 feet.
Mean pressure of steam above atmosphere per square inch in boiler, with Cumberland coal,	14·67 pounds.
Initial pressure of steam above atmosphere per square inch in cylinder with Cumberland coal,	12·47 "
Cutting off at, from commencement of stroke of piston,	3 feet.
Double strokes of piston per minute, with Cumberland coal,	15·675
Consumption of Cumberland coal per hour with natural draft,	676 pounds.
Mean pressure of steam above atmosphere per square inch in boiler, with anthracite,	14·75 "
Initial pressure of steam above atmosphere per square inch in cylinder,	12·55 "
Cutting off at, from commencement of stroke of piston,	3 feet.
Double strokes of piston per minute with anthracite,	14·88
Consumption of anthracite per hour with natural draft,	713.

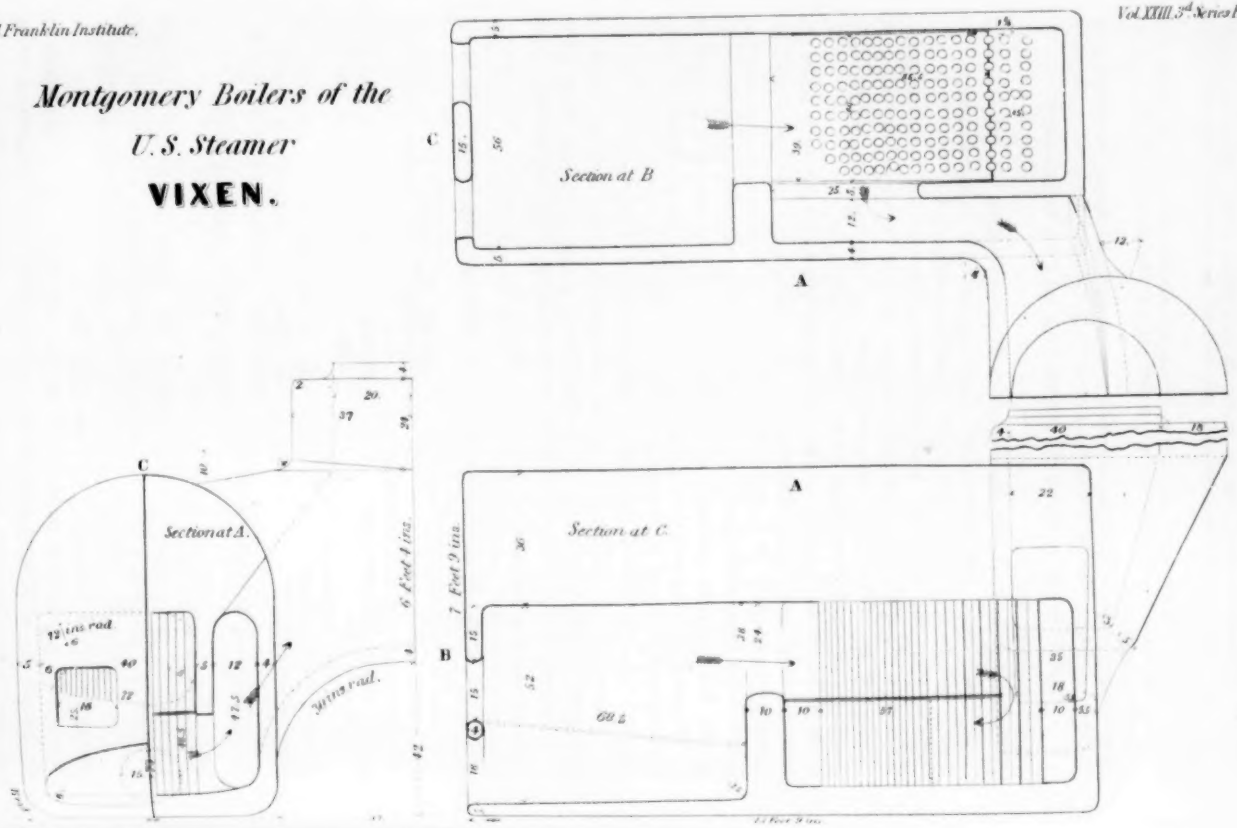
Proportions.

Proportion of heating to grate surface,	20·336 to 1·000
" grate surface to cross area of side flue,	7.090 "
" " " spaces between tubes above diaphragm,	7·016 "
" " " below "	7·624 "

Proportion of grate surface to cross area of smoke chimney,	6·126 to 1·000	
" heating surface to cross area of side flue,	144·180	"
" " " spaces between tubes above diaphragm,	142·670	"
" " " below "	155·050	"
" " " of smoke chimney,	124·857	"
" " per cubic foot of space displacement of piston,	25·699	square feet.
" " " " per double stroke per minute, taking the mean of the double strokes, with bituminous and anthracite coals, viz. 15·28 per minute,	1·682	"
Proportion of grate surface per cubic foot of space displacement of piston per double stroke per minute,	0·083	"
Proportion of grate surface per cubic foot of space displacement of piston,	1·264	"
Proportion of steam room per cubic foot of steam used per stroke of piston,	16·865	cubic feet.
Consumption of bituminous coal with natural draft per square foot of grate surface per hour,	12·600	pounds.
" " heating " "	0·620	"
Sea water evaporated with bituminous coal by one square foot of heating surface per hour,	3·248	"
" " by 1 pound of bituminous coal per hour,	5·237	"
Consumption of anthracite coal with natural draft per square foot of grate surface per hour,	13·300	"
" " heating " "	0·658	"
Sea water evaporated with anthracite by one square foot of heating surface per hour,	2·729	"
" " by one pound of anthracite per hour,	4·713	"

From the foregoing data, it will be perceived that the economical effect from the bituminous exceeded that from the anthracite by 11·12 per cent. of the latter, although the results from both kinds of coal are low. The cause of this is undoubtedly to be found in the proportions of the boiler. The proportion of least calorimeter or area of draft is but 1·000 to 7·016 of the grate surface, with a chimney only 48 feet high above the grate, and there was burned on each square foot of grate 12·6 and 13·3 pounds of coal. This calorimeter was entirely too small to furnish the necessary supply of atmospheric air for even the bituminous, much less for the anthracite, which, containing more of the carbon and less of the hydrogen constituent, requires a much greater amount of air for equal quantities of the coals. According to Prof. Walter R. Johnson, a pound of Cumberland bituminous coal requires for its combustion, 237·21 cubic feet of air at the standard temperature of 60° F., and 30 inches of the barometer; while the combustion of a pound of anthracite requires 340·42 cubic feet of the same air, or $30\frac{3}{10}$th per cent. more than the latter. There was thus not only this greater amount of air required for the anthracite, but there was a much less velocity of draft to furnish it, for as the anthracite evaporated a less quantity of water than the bituminous, (equal weights of each,) and as the amounts of the two kinds of coal burned in equal times may be considered practically the same, the difference being but $5\frac{3}{10}$th per cent. of the greater quantity, there was less heat present in the flues during the combustion of the anthracite, and consequently a less draft. Had the proportions of the boiler been proper for the combustion of anthracite, it would doubtless have given the superior result due to it theoretically, and obtained elsewhere practically,

Montgomery Boilers of the U. S. Steamer **VIXEN.**



where proper conditions have been observed. With this greater deficiency of air for the anthracite than for the bituminous, a proportionally larger amount of the carbon constituent in the fuel went off in the form of carbonic oxide, instead of carbonic acid gas.

COMPARISON OF THE ORIGINAL WITH THE "MONTGOMERY" BOILERS.

The two kinds of boiler would supply equal amounts of steam in equal times, until the "Montgomery" choked up; while no choking up was experienced with the original boilers.

	Original Boilers.	Montgomery Boilers.	
Cubic contents of circumscribing parallelopipedon,	1422⅔ cu. ft.	1172.18 cu. ft.	or as 1.214 to 1.
Areas of grate surface,	47 sq. ft.	53·60 sq. ft.	" 0·877 "
Areas of heating surface,	750 "	1090·00 "	" 0·688 "
Areas of least calorimeter, proportionally to grate surface,	7·457	7·624	" 0·978 "
Height of chimnies above grates,	43¾ feet.	48 feet.	" 0·912 "
Pounds of bituminous coal burned per hour per square foot of grate,	12 pounds.	12·600 pounds	" 0.952 "
Proportion of heating to grate surface,	15·958 to 1.	20·336 to 1.	" 0·784 "
Pounds of sea water evaporated per hour from 100° F. by 1 lb. bituminous coal,	4·107 pounds.	5·237 pounds	" 0·784 "
Pounds of sea water evaporated per hour by one square foot of heating surface,	3·089 "	3·248 "	" 0·951 "

Although the above figures show an economical evaporation in favor of the Montgomery boilers, in the proportion of 1·000 to 0·784, both burning bituminous coal, yet it must be remembered that with the original boilers, the bituminous was the Pittsburg variety, while with the Montgomery boilers, the bituminous was the Cumberland variety. Turning to the carefully conducted experiments of Prof. Walter R. Johnson, made at the government expense on various coals, I find the evaporation of fresh water from a temperature of 212° F., by one pound of Cumberland bituminous coal, to be 9·98 pounds, and by one pound of Pittsburg bituminous coal, to be 8·20 pounds, or the evaporative effects of the two coals compare as 1·000 to 0·821, or differing but $3\frac{7}{10}$th per cent. from the relative evaporation obtained in the *Vixen's* boilers.

Making the necessary allowance then, for the different evaporative powers of the different coals used, and for the fact of the one boiler being old and foul, and the other new and clean, there appears to be no superiority due to either *type* of boilers considered as such.

The indicator diagrams were taken during the performance of the Montgomery boilers, and are added to show the action of the cylinder valves, cut-off, &c.

INDICATOR DIAGRAMS FROM THE STEAM CYLINDER.

FIG. 1. Plate III.—Steam, per gauge in boiler, 12 lbs.; vacuum, per gauge in condenser, 26 in.; double strokes of piston per minute, 17; mean effective pressure per square inch, 16·6 lbs.; throttle wide.

FIG. 2.—Steam, per gauge in boiler, 15 lbs.; vacuum, per gauge in condenser, 24 in.; double strokes of piston per minute, 16; mean effective pressure per square inch, 14⅓ lbs.; throttle wide.

FIG. 3.—Steam, per gauge in boiler, 5 lbs.; vacuum, per gauge in condenser, 25 in.; double strokes of piston per minute, 9; mean effective pressure per square inch, 5·6 lbs.; throttle close shut.

FIG. 4.—Steam, per gauge in boiler, 16½ lbs.; vacuum, per gauge in condenser, 24 in.; double strokes of piston per minute, 14; mean effective pressure per square inch, 15 lbs.; throttle wide.

On Marine Propulsion. A Reply to J. W. Nystrom, Esq. *By* J. V. Merrick.

The reply of Mr. Nystrom to my remarks in the January number, presents so clear a case of misapprehension in the first principles of dynamics, that I think it will not be difficult, by reference to any treatise on that subject, to prove his positions entirely untenable.

Those positions, as nearly as I can understand them, are—1st, That there is some grand difference between the action of propellers and paddle-wheels, in virtue of which the revolutions of a screw may be considerably increased without altering the slip, while such a result cannot be expected when a paddle-wheel is employed; and, 2d, That "slip" is not a measure of loss of effect.

Let us examine the subject in detail. The effect of a constant force is composed, 1st, of the intensity of its effort, and 2d, of the space passed through; and consequently, its effect in a given time is the product of its intensity and its velocity. This effect has received from different authors various names, of which the "quantity of work" appears to be the most expressive.

It follows from this definition, that when no velocity is obtained, or in other words, when a body in which a force acts is immovable, there is no "work" expended; and it follows also, that if a constant force is acting to separate two bodies, its intensity of effort, which may be called its resistance or pressure, will act equally on each body, and the quantity of work expended on each, will be expressed by the product of this intensity, or resistance, or pressure, and of the velocity maintained by each; and that the sum of these products must always equal that of the original pressure or intensity of effort, and of its velocity.

Now, suppose the case of a locomotive moving upon a railway; the driving wheel may be considered as a lever, through which the power developed by the engine is transmitted to the rail, each point of which, as the moving driving wheel comes in contact therewith, forms the point d'appui against which acts the power of the engine to propel itself and train; and if this power be equivalent to a weight of 100 pounds constantly acting at the velocity of the circumference of the driving wheel, then if the friction or "hold" upon the rail just equals 100 pounds, the wheels will turn without slipping upon the rail; in this case, the velocity of the train in a unit of time, multiplied by the resistance it offers to motion at that velocity, just equals the whole available power of the engine in that time. But if the power developed by the engine be increased by the employment of larger cylinders with the same steam pressure, this power transmitted to the circumference of the driving wheel will be increased either in intensity or in velocity. As, however, the friction was before just equal to the resistance offered by the train at its former velocity, and as the pressure can never exceed the friction or resisting pressure, the increase must take place in the velocity. But the velocity of the train cannot be increased, because it requires a pressure equal to the friction, to give it that velocity. Hence the circumference of the driving wheel must revolve faster than the engine can advance,

or in other words, must slip upon the rail. The ratio of this "slip" to the velocity of the driving wheel, is the per centage employed in what may be called *propelling the friction backwards*, which is non-utilized effect.

In the case of a paddle-wheel steamer, supposing there is no oblique action, and that the whole area of the float is concentrated at the centre of effort, the rail is replaced by the water, and the friction of the rail by the power required to put in motion that water. Now as water is a body whose particles are free to move upon one another, it follows that no pressure can be applied to it without producing motion; hence the power transmitted to the centre of effort revolving at a certain velocity, must not only give rise to a forward motion of the vessel, but to a retrograde movement of the water, called "slip;" and by the law of dynamics, previously mentioned, the available power of the engines when uniform motion is attained, will therefore be divided as follows: 1st, the pressure at the centre of the float will give rise to a certain velocity of the vessel, dependent on its form and dimensions, the product of which, by this pressure, expresses that portion of the power expended in propelling the vessel, and is called "utilized effect;" 2d, the same pressure at the centre of the float, will give rise to a certain velocity of the water, in a sense opposite to that of the vessel's motion, dependent on the form, dimensions, and arrangement of the floats on the wheel, which velocity multiplied by the said pressure, expresses that portion of the power employed in propelling the water backward, and is called "non-utilized effect." As the same pressure is an element in both these expressions, and as the sum of the two effects must be equivalent to the available power of the engines, it is obvious that the sum of the two velocities is equal to that of the centre of pressure of the float, and that the ratio of non-utilized effect to the whole power available, is measured by that of the velocity of the slip to the velocity of the wheel.

If this be not clear enough, the case may be stated in another way. Suppose a paddle-wheel steamer to be tied to a wharf, her engines to be in uniform motion, and steam of a given pressure to be admitted freely to the cylinders. Then, according to the relative velocities of the wheel and the crank pins, this power becomes at the centre of effort of the former, equivalent to a certain velocity multiplied by a certain pressure, which is capable of giving a certain velocity to the water put in motion by the floats, depending on their form, arrangement, and dimensions. Here the whole effect of the engine transmitted through the shafts, is non-utilized in propelling, because the vessel has no velocity. If, now, the engines being still working with the same steam pressure, the vessel be untied, after the first instant of time, if we can suppose uniform motion to be attained during an indefinitely short period, the retrograde velocity of the water will have been diminished, that of the vessel (forward) increased, (since it was before $= 0$,) and that of the engines increased, thereby augmenting the *power* developed, although the *pressure* remains precisely the same as before. At the end of successive instants of time, the same effects will be exaggerated, the *pressure* always remaining the same, until an absolute uniformity of motion is attained; when it will be found that the opposing resistances are in equilibrium

(not the opposing *effects*,) and that the resistance of the water thrown back by the wheels, is precisely equal to the resistance opposed by the water and air to the advance of the vessel. And then, the ratio of the coefficient* of the vessel, and of the area of the floats brought into action while the vessel goes over an unit of space, multiplied by the coefficient for resistance to plane surfaces at the given immersion, determines (inversely) that of the velocity of the vessel, forward, to the velocity of the water backward.

For example, if the coefficient of a vessel be 40, and the area in feet of the propelling surface of the floats, acting while the vessel advances through a unit of space, = 240, then the slip should be $\frac{40}{240+40} = \frac{40}{280} = \frac{1}{7}$ or 14 per cent., nearly.

The same principles must govern us in the consideration of the screw propeller. Suppose, as before, that a screw vessel is tied to the wharf, and steam of a given pressure freely admitted to the pistons, which are in uniform motion; then the power developed, after the requisite deductions are made, is transmitted through the shaft, and according to the ratio of velocities of the pitch of the screw, and of the crank pins, becomes at its centre of effort, a certain pressure exerted in the direction of the axis, which pressure is capable of giving a certain velocity to the water put in motion by the propeller blades, depending on their form, arrangement, and dimensions. Here the whole available power of the engines is non-utilized effect, since the vessel has no velocity. If, now, the vessel be untied, and if after the first instant of time we suppose uniform motion to be attained for an indefinitely short period, the retrograde velocity of the water will have been diminished, the forward velocity of the vessel increased (since it was before = 0,) and that of the engines increased, thereby augmenting the power developed in a given time, though the *pressure* on the propeller remains the same. At each successive instant of time, the same effects will have been exaggerated, until at length uniform motion will be attained, when it will be found that the opposing *pressures* are in equilibrium, or in other words, that the resistance of the water thrown back by the propeller, is precisely equal to the resistance opposed by the water and air to the forward motion of the vessel; and that the ratio of the coefficient of the vessel to the projected area (in square feet) of the blades acting while the vessel passes through an unit of space, multiplied by the coefficient resistance per square foot to a plane surface, will be inversely that of the relative velocities of the vessel and of the water in opposite directions.

For example, in the case of the San Jacinto, the pressure required to propel her at a velocity of $\frac{968}{60} = 16{\cdot}11$ feet per second, was (by dynamometer) 12,815 pounds. Hence her coefficient was $\frac{12{,}815}{16{\cdot}11^2} = 49.3$.

* By the "coefficient" of a vessel, I mean that number which, multiplied by the square of its velocity, and by the mass of a cubic foot of water, equals the number of pounds required to propel her at that velocity; for sea water the mass $= \frac{P}{2g} = \frac{64{\cdot}5}{64{\cdot}33}$ or 1·, nearly.

The area of her propeller blades projected on a plane perpendicular to the axis, is 108·5 sq. feet. But the projected area acting to propel, while the vessel is advancing over a unit of space, is (as I shall hereafter show,) equal to that of the propeller, in rest, multiplied *by the secant of the angle, whose tangent multiplied by the circumference, is the advance of the vessel during a revolution.*

The coefficient of plane surfaces propelled through liquids, is various at different speeds, and under different circumstances. Beaufoy, in one set of experiments, found it to be for water (near the surface) 1·08; and in another set, 1·12. (Theoretically it should be $\frac{P}{2g} = \frac{64·50}{64·33} = 1$, nearly, for sea water; P being the weight of a cubic foot,) and it of course varies with the immersion. As we are now viewing the theory of the screw, however, and cannot ascertain its value within the limits of 1· and 1·12, we shall assume it = 1·00, which will be near enough for the purpose.

At twenty-five per cent. slip of the San Jacinto's propeller, the secant of the angle before mentioned, which is $\frac{(\text{circ.})^2+(\text{advance})^2}{(\text{circ.})^2} = 1·40$, so that its acting area was 108·5 × 1·40 = 151·9 square feet. Hence the slip should be $\frac{49·3}{151·9 + 49·3} = 24·5$ per cent., while the slip observed = 26·27 per cent.; while the velocity of pitch if this were the correct slip would be $16·11 \left(1 + \frac{24·5}{100—24·5}\right) = 21·33$ feet per second. This is as near a result as calculation will give, when it is considered that a part of the blades near the axis were probably not efficient, or that from disturbing influences, the coefficient was less than 1. If for example, it were ·911, then $\frac{49·3}{(151·9 \times 911) + 49·3} = 26·27$ per cent.

Enough has, I think, been said, to show that *the pressure constantly exerted by a screw propeller or side wheel, always remains the same with a given pressure in the cylinders, and is entirely* independent of the velocity at which the vessel moves. Hence in the case of the tow-boat, (adduced by Mr. N.,) the *pressure* exerted by her propeller or wheel, is always the same with the same steam pressure, no matter what number of vessels she may have in tow; and the effect utilized, would therefore be always in exact ratio with the difference between unity and the per centage of slip, provided the acting area of the propeller was the same. Let us suppose as an example, that the San Jacinto should take in tow another vessel possessing the same coefficient, and that steam of the same pressure as before, be admitted to her engines. The sum of the coefficients would then be 49·3 × 2 = 98·6. Then the velocity at which the vessels would move, would be $\sqrt{\frac{12815}{98·6}} = 11·4$ feet per second. In order to approximate the acting area of the propeller, suppose the slip to be 41 per cent., then secant $\frac{2}{3} = 1·28$, and 108·5 × 1·28 = 139 feet.

Hence slip $= \frac{98{\cdot}6}{139 + 98{\cdot}6} = 41{\cdot}4$ per cent. So that the velocity of the pitch will be $11{\cdot}4 \left(1 + \frac{41{\cdot}4}{100-41{\cdot}4}\right) = 19{\cdot}47$ feet per second. Hence the powers developed by the engine will be in the two cases, as 21·33 to 19·47, or as 1· to ·913, while the utilized effects produced, are as $(16{\cdot}11)^3$ to $(11{\cdot}4)^3 \times 2$, or as 1 to ·709. In like manner, we may find for the cases, when two such vessels are towed, a slip of 53·2 per cent.

"	three	"	"	"	"	61·0	"
"	four	"	"	"	"	67·4	"
"	five	"	"	"	"	71·8	"
"	six	"	"	"	"	75·0	"

The acting area of a screw has been supposed by some authors to be the projected area of all its blades on a plane perpendicular to the axis; by others, to be their absolute area, on the supposition that their action is perpendicular to the surface; by others, again, the area of the circumscribing circle. It appears to me, however, to be neither of these; but the projected area by the ratio of length between the helicoidal path traversed by the centre of effort, and the circumference of the circle in which it moves; and for the following reason: the coefficient of a vessel (before alluded to) represents the area of a plane, whose resistance would be equivalent to that of the vessel; consequently the quantity of water which may be said to be displaced by the vessel, is that which would be displaced by this plane, or is equivalent to the product of its area and of its advance. Now the water displaced by the blade of a screw, is a volume whose area is that of the helicoidal path traversed by the whole blade, and whose length is the slip; with the velocities of these two displacements, we have nothing to do; we have simply to compare the "acting area" of the blades, and the "propelled area," as it may be styled, or coefficient of the vessel; and as the area of the helicoidal path of the whole blade is to its projected area on a plane perpendicular to the axis of the screw, as the secant of the angle it forms with that plane is to unity, it results that the product of this projected area by the secant of this angle, is the "acting area" of the blades. Or, it may be thus stated: each point in the surface comes in contact with, and therefore sets in motion, every particle of water it glides over during its revolution, and as the aggregate of all these particles forms the helicoidal line traced by the blade, it is clear that a body of water is moved during its revolution by that point, proportional to the length of that line. Now if the vessel have no motion, this helicoidal line becomes the circumference of the circle in which it moves; and if the vessel have any forward movement, the angle formed by the helicoidal path over which the centre of effort passes, is such that its tangent, multiplied by the circumferential movement, equals the advance; and it is this angle whose secant forms the multiplier for the projected surface of all the blades, to obtain their acting area. It thence follows that this area diminishes as the slip increases, of course diminishing the resistance requisite to put the water in motion.

With a paddle-wheel, the reverse is the case; there the number of floats immersed during the advance of the vessel over a unit of space,

increases with the slip. For example, if a paddle-wheel have 30 floats, and if 20 revolutions cause its centre of effort to move over 1000 feet, and its propelling area = area of floats immersed, $\times \frac{30 \times 20}{1000} = \cdot 60$ N.; then if the vessel advances over only 900 feet, (or if the slip is ten per cent.,) the number of floats immersed during its passage over 1 foot, would be $\frac{30 \times 20}{900} = \cdot 67$ N.; if over 800 feet, with 20 per cent. slip, $\frac{30 \times 20}{800} = \cdot 75$ N., and so on in the ratio of $\frac{1}{1-S}$, and as the volume of water set in motion is equal to its area multiplied by the recession of the water, while that of the water displaced by the vessel, is equal in value to the area expressed by its coefficient multiplied by its advance; and inasmuch as we have nothing to do with the *velocities* with which either volume is moved, we have to compare the acting and propelled areas, which in this instance approach in value as the slip diminishes.

Such are the indications of theory; but it is found that the values given by them, are but approximative, and that there are some modifying circumstances experienced in practice. Among others, may be noticed the fact, that as propelling surfaces approach more nearly to each other, or follow each other more rapidly, the disturbance of the water diminishes their efficiency; that water impinging on surfaces at more oblique angles, increases its pressure more rapidly than is justly due to its velocity, and that consequently, it opposes greater resistance to surfaces striking it at very acute angles; that the lines of a vessel astern, have great influence on the resistance offered to its propeller by the greater or less facility with which the water falls into the wake; that the coefficient of a vessel increases at high rates of speed, &c., &c. The great principle, however, remains the same, viz: that *slip* with the same relative propelling area and coefficient, *is a measure of loss of effect*, and that in all propelling agents (now known), the change in propelling area at different slips within the ordinary limits, when taken in connexion with the different resistances offered by the water under these different circumstances, is not so great as materially to affect this condition in practice.

And now for a notice of some of Mr. Nystrom's observations. In the first place, when quoting my remark, that "heavy weather at sea" is apt to increase slip; he adds, "we may as well say a good fair wind, which then would decrease the slip; these are the results of circumstances." What has been said will show that the "circumstances" are generally on one side of the question, and that while a very moderate increase of resistance increases slip, it requires a far greater force to equally diminish it. In fact, the experience of all screw steamers is, that the average slip during an ordinary voyage, is greater than that attained under the favorable circumstances of smooth sea and calm. In the next place, it is unnecessary to recapitulate in order to show that the same general principles cover the case both of paddle-wheels and propellers, when it is a question if velocity can be increased with the same resistance and slip. 3d, Mr. N. says, that "if we suppose the slip to be 100· (that is, when the vessel

stands stationary, and the propeller is running,) and the slip is a measure of the loss of effect as described by Mr. Isherwood, then the slip should take away *all the effect* from the steam engine, and not allow any for the friction and working the pumps." Now these latter elements have nothing to do with the question; they are absorbed and utilized before the power developed by the cylinders reaches the shaft; consequently, are not transmitted to the propeller, and do not form a part of the total power in which the per centage of loss is calculated. If, for instance, a power of 100 horse power be developed, and it require 10 horse power to overcome friction, &c., it is but 90 horse power which is transmitted to the propeller. Again, with reference to the tow-boat question.

"Again, let us take a few steps back, and suppose the slip to be 80 per cent., which is often the case with tow boats; then, if the loss of effect is 80 per cent., there is only 20 per cent. left, which is nothing more than what is required for the friction and working the pumps, consequently nothing left as useful effect for towing; still the vessel is running, and in this age of common sense, we do not believe that witchcraft tows the vessel; take the same tow boat to tow a smaller vessel, which causes a slip of only 50 per cent.; the friction and working the pumps being the same, 20 per cent., then there remains 30 per cent., as useful effect for towing. We see now that if slip is a measure of loss of effect, it requires more power to propel a small vessel, and no power to propel the largest vessel."

Here we find the same error as in the former case—the whole structure of the argument is built upon sand. Again, in reference to the comparison of a locomotive with a steam vessel, it is intimated that if we "try the experiment with a locomotive in water, we shall find it run as well without wheels." Undoubtedly; it would probably sink—but if that difficulty were overcome, it would advance quite as rapidly as the finest screw vessel, if drawn upon shore, and her engines were driven at full power. The comparison is entirely irrelevant—as much so as to assert that a man exercised no power in walking, because, if suspended in the air, he could not advance by the same movements of his limbs.

Finally, The calculation into which Mr. N. enters at the conclusion of his article, is a lamentable instance of implicit faith (without examination) in the old doctrine that "action and re-action are equal and in opposite directions;"—a form of expression which ought never to be quoted or used without the substitution of the proper terms, "pressure and resistance" for "action and re-action."

The very first equation given in that calculation is erroneous—it should have been $p=r$;—consequently the results attained by it are valueless.

It is unnecessary to quote or reply at greater length, although the question is by no means exhausted—and with any persevering reader who may not have "dropped off" ere this, I shall rest what I believe to be a "clear case."

For the Journal of the Franklin Institute.

Description of the Steamer "City of Norfolk."

This steamer, constructed in Baltimore, has been recently put on the New York and Richmond line. She was built for Messrs. Mailler & Lord, of New York, Agents and part owners.

HULL—Bell & Brothers, Builders.

Length between perpendiculars, . 165 feet.
" on deck, ... 180 "
Breadth of beam, ... 27 "
Depth of hold, ... 17 " 3 inches.
Midship section immersed at trial, 240·67 sq. ft.
Tonnage: Register, 571 tons; Carpenter's measure, 729 tons.
Rig, 3 masts; fore and aft sails.

ENGINES—By Murray & Hazlehurst, Vulcan Works.

Cylinders—two: inverted, direct action, and connexion.
Diameter, . . . 2 feet 8 inches.
Length of stroke, . . 2 feet 8 inches.

One Air Pump, solid piston, double acting, driven by beam and connecting rod from main crank shaft.

SCREW—Of Cast Iron.

Diameter, . . . 9 feet 2 inches.
Pitch, (expanding,) . { 15 feet 6 inches at entrance. / 19 feet at exit.
3 Blades; absolute width at periphery, 4 feet 9 inches.
" at hub, 1 foot 6 inches.
Fore shortened view on disk, at periphery, 4 feet 1 inch.
" " " at hub, 6 inches.
Absolute area of all blades, . . 44·6 sq. ft.
Projected " " . . . 24·7 sq. ft.
Thickness at periphery, . . . $\frac{5}{8}$ inches.
" at hub, ... 4 inches.

BOILERS—Two: flue and return tubular.

External dimensions—width 8 feet; length 18 feet 2 inches.
Heating surface, both boilers, 1824 sq. feet.
Grate " " " 44 sq. feet, or in the ratio of 21·71 to 1·00. Each boiler contains 2 flues 18½ inches, 2 flues 14½ inches, and 2 flues 10½ inches diameter, 8 feet 2 inches long, and 75 tubes 4 inches diameter, 6½ feet long, the upper tubes on a level with crown of furnace.
Collective area, both boilers, of flues, 14·44 sq. feet.
" " " of tubes, 15·70 sq. feet.
Ratio to grate surface of flues, . . $\frac{3 \cdot 1}{3 \cdot 2}$
" " " of tubes, . . $\frac{1}{3 \cdot 3}\frac{3}{5}$
Chimney, 56 inches diameter, or area 17·1 sq. feet, and 55 feet high above grate bars.

Performance in the Bay on first trip from Baltimore to New York.

Revolutions averaged 60 per minute.
Steam averaged 20 to 22 lbs., cutting off at half stroke.
Speed averaged 10·22 miles per hour, as follows:
Time 6 hours 39 minutes.
Distance run 68 miles, by United States Coast Survey Charts.
Draft of Water—Forward, 10 feet 4 inches.
" " Aft, 12 feet 6 inches.
Ship very deep, and drawing too much by the stern.

Fuel—Consumption not accurately ascertained, but estimated at 1300 pounds per hour.

Slip—Mean pitch $=\frac{19+15{\cdot}5}{2}=17{\cdot}25$ feet. The velocity normal to pitch was $17{\cdot}25\times60\times60=62{,}100$ feet$=11{\cdot}76$ miles per hour.

Slip, therefore, $=\frac{11{\cdot}76-10{\cdot}23}{11{\cdot}76}=13$ per cent., a very excellent result.

M.

For the Journal of the Franklin Institute.

A Series of Lectures on the Telegraph, delivered before the Franklin Institute. Session, 1850–51. *By* Dr. L. Turnbull.

Continued from page 191.

The Electric Telegraph between England and France. Extension to Ireland and Belgium.

The first wires for the Submarine Telegraph were sunk in the British channel on the 27th of August, 1850. The wire was thirty miles long, with a covering of gutta percha half an inch in diameter, the wire imbedded by leaden clamps of twenty and twenty-five pounds, to the bottom of the sea; the clamps were streamed out at every sixteenth of a mile, and the wire was safely sunk to a depth which was hoped would place it out of the reach of anchors or monsters of the deep; and the other end of the wire was run up the cliff at Cape Grinez, to its terminal station on the French side of the channel, and messages were passed between the two countries.

But unfortunately for the first effort, in the course of a month, the wire received so much injury on a rock off Cape Grinez, as to make it entirely useless, and upon a careful consideration, the Directors of the Company determined to lay, instead of one, "four permanent wires."

Upon an examination by divers, it has been found that where the rupture of the coil occurred, it had rested on a very sharp ridge of rocks, about a mile out from Cape Grinez, so that the leaden weights, hanging pannier-like on either side, in conjunction with the swaying of the water, caused it to part at that point; while at another place, in shore, the shingle from the beach had the effect of detaching the coil from the leaden conductor that carried it up the Cape.

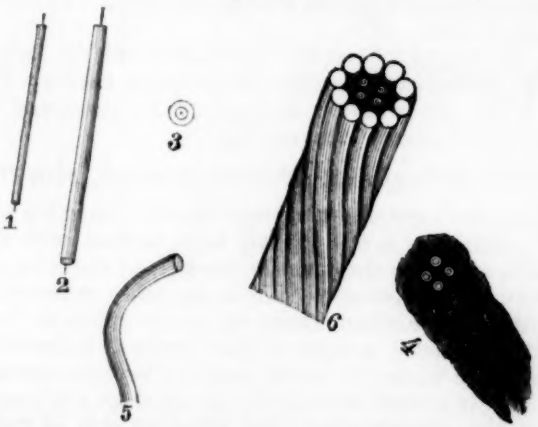
The wire, in its gutta percha coating, was consequently cut in two places, representing a remnant of wire of about four hundred yards, which was allowed to drift away, till it came into the possession of a fisherman of Boulogne; and it was no wonder that it was cut, being represented as not thicker than a lady's stay-lace, while it ought to have been as thick as the cable of those placed in the Britannia tubes in position, say eight or ten inch cable, and to be submerged below five fathoms, by the aid of enormous weights, so as to avoid all currents.

In the *London Mining Journal* for November, 1850, Mr. J. J. Lake, of the Ordnance Office, Plymouth, proposes, in order to prevent injury to the telegraphic wires, from the nature of the bottom, to suspend them

by corks placed at intervals, and to secure them to the bottom by anchors or a dead weight, at certain greater distances, and at each anchor, or weight, a small buoy, with a flag, could be secured, which would indicate their locality; and in the event of accident, they could readily be found.

I will now state the present condition of this communication, and the means taken to secure it from accident; and I will then describe the form of telegraph which is employed by Mr. Brett. In *L'illustration Journal Universel*, for October, 1851, it is stated that in this, the last effort, they had not calculated for the proper amount of cable, when first taken across the channel, it requiring a mile more cable, but the accident was soon repaired. The engraving is one taken from that Journal, and they remark that it is indeed a wonderful work. The cable of wire in which is enclosed the electrical conductor, was manufactured in the short space of three weeks, by means of a machine, the invention of Mr. Fenwick, an ingenious English engineer. It is hoped, that to preserve the conducting wire free from accidents which caused the first experiment to fail, by the present arrangement four wires are enveloped in a double cover of gutta percha, and each re-covered with cable lying at the bottom of the sea. The covers forming, together, a length of ninety-six miles, over which is placed a linen covering prepared in a composition of tar, tallow, &c., and crossing its length the centre of the cable.

Fig. 54.



No. 1, fig. 54, is the first covering of gutta percha; No. 2, is the second covering, re-covering the first; No. 3, section of the covering No. 2; No. 4, is the wire in the covering of tarred linen; No. 5, is the simple wire of galvanized iron; the covering is that of zinc; No. 6, is a view of the arrangement of the cable, showing the galvanized iron wire, &c.

To recapitulate:—The rope is 24 miles long, and consists of four copper wires, through which the electric current will pass, insulated by coverings of gutta percha. These are formed into a strand, and bound round with spun yarn, forming a core or centre, round which are laid ten iron galvanized wires of 5-16ths of an inch diameter, each welded

into one length of 24½ miles, and weighing about fifteen tons. The rope weighs, altogether, about 180 tons; it forms a coil of 30 feet in diameter outside, 15 feet inside, and five feet high, and was in good working order in September, 1851. English papers received by the arrival of the Niagara, on Friday, December 12th, 1851, state that the Sub-marine Telegraph is working well. Messages on the same day have been transmitted from London and Liverpool to Paris, Havre, Vienna, Trieste, Hamburg and Ostend; and in one instance, a communication was forwarded to Cracow, to be despatched thence by mail to Odessa.

The rates are, for a message of twenty words:—

From Paris to Calais.	. . . . .	7f.	56c.
" " Dover,	. . . . .	19f.	56c.
" " London,	. . . . .	32f.	81c.
" " Birmingham,	. . . . .	—	—

From Paris to Brighton, Cheltenham, Coventry, Gloucester, New Market, Norwich, Oxford, Portsmouth, Southampton, &c., 26f. 03c.

From Paris to Chester, Edinburgh, Glasgow, Holyhead, Liverpool, Manchester, New Castle, Nottingham, Sheffield, York, 29f. 31c.

Now that the English channel has been crossed in so substantial a manner, and with such perfect success, the crossing of the Irish channel must follow; for the same Company will perform this important work.

By their act of incorporation they are styled "The Submarine Telegraph Company between England and France, between England and Ireland, and the European and American Printing Telegraph," all proposed by Mr. Jacob Brett, in 1851.

Messrs. Carmichael & Brett have contracted with the Belgian Government for the formation of a submarine telegraph between Belgium and England. They are to have a monopoly of ten years, and the governments are to have priority of all messages.

Description of Brett's Printing Telegraph, Plate IV.

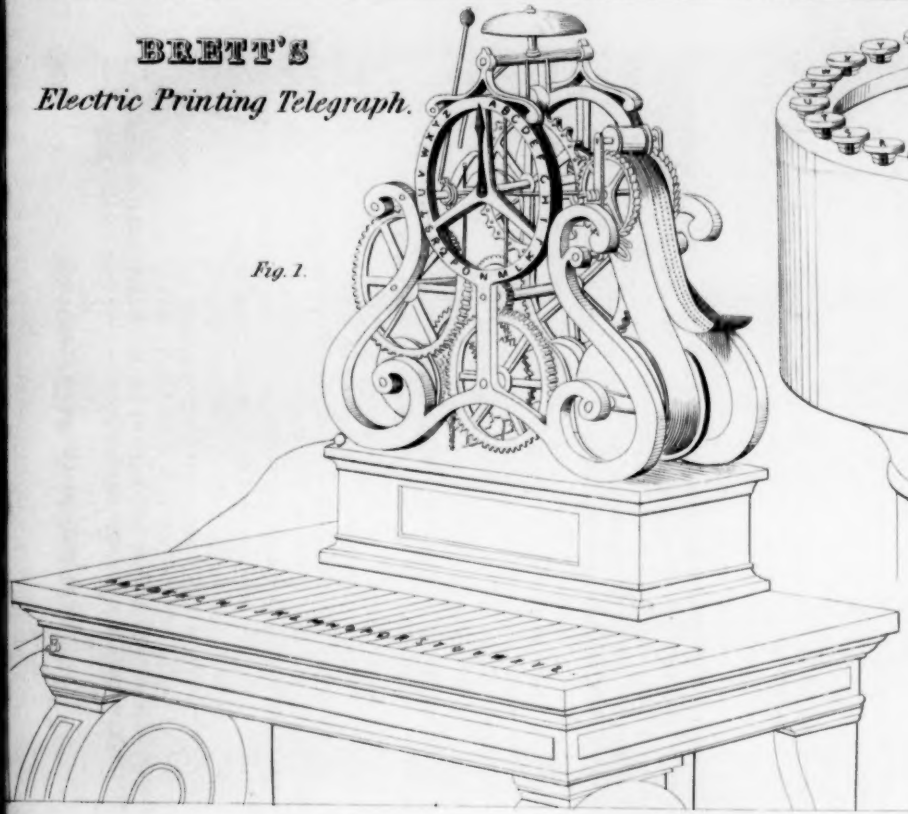
Suppose at one extremity of *a single line* of telegraphic wire, a small key board, containing a row of ivory keys, marked with the letters of the alphabet, and other characters or words; and that it be connected by the said wire to the printing machine at the other extremity. This machine contains a type wheel, having on its circumference corresponding letters, words, or signs; a slight electric power is sufficient to regulate the motion of the whole, so that the instant a key representing any word, letter, or sign, is pressed down by the person at the key board at one end of the line, the corresponding word, letter, or sign of the type wheel prints, and the signal bells ring at the other end of the line of telegraph, without limit as to distance. The communications are printed on paper supplied from a scroll of unlimited length, from which any portion of the correspondence may be cut off at pleasure.

The motive power is simple; it being that of a weight, which sets in motion the key shaft and governor of the key board; and the circuit wheel in connexion with the shaft being put in contact with the wire of the galvanic battery, or other generator of electricity, according to the velocity of motion and manipulation at the key board, so will the motion be fast or slow at the printing end of the telegraph; the type wheel of the

BRETT'S

Electric Printing Telegraph.

Fig. 1.



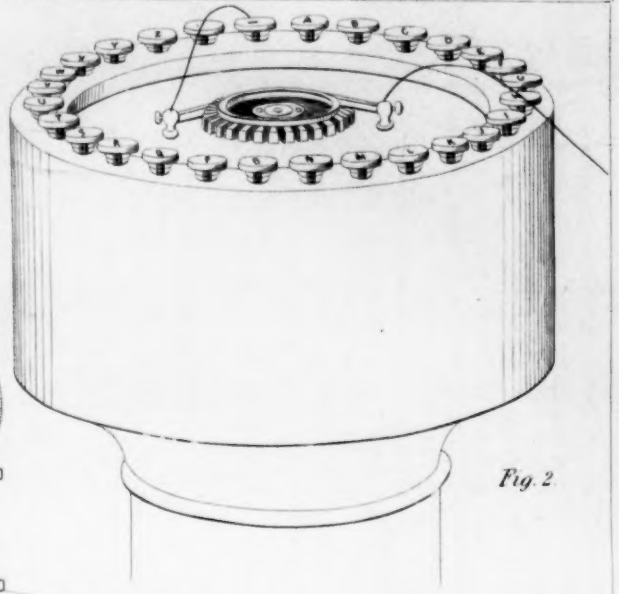


Fig. 2.

telegraph is set at liberty by means of an escapement, and weights in connexion with it, so as to print with a like velocity, in combination with an hydraulic or pneumatic regulator, which admits of the desired letter *only* being printed, by checking and releasing an eccentric arrangement; a rod from thence unites with the cylinder on which the paper is printed, in various modes, as may be desired, either in paragraphs—on a sheet of paper—upon a long strip of ribbon or paper—or, if for government despatches and the like, it can be printed line by line, like the column of a newspaper, of an unlimited length.

Fig. 2 represents a separate key board, of a circular form, from which communications can be forwarded to any or every station in connexion with it, the letters, words, or characters being arranged round it on the keys; and these, if depressed by the fingers, will check the motion of a pin, or shaft, and also of the circuit wheel fixed to the same axis, at such given point or key, by which means the operator may make or break the circuit of conductors at such letter or point.

The distance actually proved to act by this telegraph in one continuous line has been 230 miles, and 340 miles apart, at the rate of 100 letters per minute. This is a modification of the House Printing Telegraph.

From the year 1847 to that of 1852 there have been so many fancied improvements made in electro-telegraphs, that it is unnecessary to consume time in describing them. The most important I have noticed in full; but in the majority, I have only described a new claim, or a good modification of an old arrangement.

The three most interesting telegraphs which have been devised in that time, are those of Henley & Foster, of England; Siemens, of Berlin, and Allen, of Edinburgh. I have arranged them chronologically, and have given a list of the publications where they may be found, especially in the instances where the description given here is limited.

Nott's Improvement in Electric Telegraph, January 20, 1846.—Novel arrangement of apparatus, by which audible and visible signals can be given, through the agency of electro-magnetism.—Rep. Pat. Inventions, 1847, p. 97.—(Irish.)

Hatcher's Improvements.—First, consisting in arranging and disposing of magnets in such a way that when an electric current is transmitted through them, gives a step by step motion. The second relates to the means of forming the metallic connexions. Third, in regulating a number of clocks.—Patent, dated March 23, 1847.—(English.)

Reid's Electro-Telegraphic Improvements.—Better insulation of the wires, by laying them in channels under ground, and covering them with gutta percha, marine glue, or tar; using a modified galvanometer to sound an alarm, and earthenware insulators.—Patent, dated Nov. 23, 1847.—(English.)

Henry Mapple, Wm. Brown, and James Lodge Mapple, Telegraphic Machine, June, 1847.—They magnetized a steel dial by electricity, and thereby made a steel pointer to move over it.—Rept. Patents, Feb., 1848.

Barlow and Foster's Improvements in Electric Telegraphs, April 27, 1848.—First, coating the telegraphic wires with a compound, consisting of one part by weight of New Zealand gum, and one part of milk of sulphur, added to eight parts of gutta percha, by little and little, while in a

kneading trough, at a temperature of 120° Fahr. The coating is effected as follows:—Two pairs of rollers are made to revolve by means of suitable gearing, at one uniform speed, and each pair is provided with a pipe, fitted steam-tight, to one end of their axis, through which pipe steam is admitted at pleasure, which serves to bring the rollers to a temperature sufficient to soften partially two bands of gutta percha, passed between them. Then, there is another pair of rollers, which have their surfaces cut with semi-circular grooves; the grooves of the one roller corresponding or falling right over those of the other. The wires to be covered are wound upon reels, from which they pass between the second pair of rollers. The bands or fillets of gutta percha are passed between the first pair of rollers, (and are so brought into an adhesive state,) and the two bands of gutta percha, with the wires between them, are in this state passed between the second pair of rollers, by which the fillets of gutta percha are made to adhere together, and consequently to envelope the wires.

2d, The governing the currents of electricity, so as to cause each pulsation thereof, separately or conjoined, to indicate different signs or symbols.

3d, The patentees describe an electric telegraph apparatus for indicating the passing and time of passing of a railway train.

A dial is pierced with fifty holes at regular distances, in which holes small plugs are placed. This dial is made to revolve once every hour. A metal spring presses against the face of the dial, and has the effect of thrusting back any plug that may have been protruded. Above the dial is an electro-magnet, which attracts, on the passing of an electric current from the station which the train has just passed, one end of a lever, the other end of which protrudes the plug immediately underneath beyond the face of the dial, so that the attendant is enabled, by looking at the dial, to see whether the train has passed the station, and what time has elapsed since it passed.—*London Mech. Mag. No.* 1319, *Nov.* 18, 1848.

C. F. Johnson, Oswego, Tioga County, New York.—Improvement in Electric Telegraphs, May 16, 1848.—Claim.—First, forming signs for telegraphic purposes, by the dropping of balls upon an endless belt moving with an uniform velocity. Second, I claim the taking off impressions on paper, from balls as dropped substantially in the manner described.—*Franklin Institute Journal, Vol.* xvii, *3d series, p.* 310.

John Lewis, Recardo, Lownds Square, Middlesex, England, Sept. 18, 1848.—1st, "Improvement" to a mode of insulating wire for electro-telegraph purposes; and 2d, to an apparatus for suspending them.—*Mechanics' Magazine, March*, 1849.

Edward R. Roe, Improvements in the Machine for Operating or Manipulating Morse's Electro-Magnetic Telegraph, May, 1849.—"The invention consists, 1st, of movable metallic types as conductors of electricity or galvanism; 2d, a metallic type bed upon which they are to rest, (which is also movable to and fro, somewhat in the manner of a common printing press;) and 3d, a movable board, which is also a conductor, and is made to traverse the face of the types, thereby making, continuing, or breaking the galvanic circuit, according to the form of the types.

Claim.—"What I claim as my invention is, 1st, The combination of

the body, the socket, the spiral ring, and the wand, with its conducting point and its non-conducting inclined planes, the whole constituting the traverser.

"2d, I claim the manner of giving the proper motion to the traverser, by the combination and action of the traverse wheel, the pully, and the cord which plays in it, the teeth upon the traverse wheel and the brakes operated by the type bed, in the manner set forth.

"3d, I claim the combination, for telegraphic purposes, of the types, arranged in the manner described, with the traverse and its wand, and its conducting point guarded by non-conducting inclined planes."—*Franklin Institute Journal, Vol.* xvii, *3d series, p.* 320.

Charles Shepherd, London.—Improvements, April 16, 1849.—1st, The employment in chronometers, of apparatus actuated by electro-magnetism for winding up the remontoir escapement, which is retained by a detent.

2d, Giving audible signals in chronometers by means of a locking plate, and apparatus connected therewith, worked by electro-magnetism.

3d, An arrangement of apparatus for making and breaking the circuit.

4th, A peculiar arrangement and adaptation of apparatus, worked by electro-magnetism to chronometers.

5th, The combination in chronometers and telegraphs, of two pallets and detents for giving the step by step motion.—*Lond. Mech. Magazine, Oct.* 20, 1849.

L. G. Curtis, Ohio.—Improvement in Indicating Telegraph, January 16, 1849.—"The basis of the American Indicating Telegraph invented by me, is upon these principles, viz: Electro-Magnetism, machinery, figures and signs, and their combinations.

"This end is obtained by means of a revolving disk or dial plate, marked with successive series of numerals, 0 1 2 3 4, arranged in a circle or otherwise, said dial plate being revolved by degrees, as the galvanic current is completed and broken by the alternate vibration of the lever, to which the pallets, armature and springs are attached."—*Franklin Institute Journal, Vol.* xviii., *3d series, p.* 280.

Caleb Winegar, New York.—Improvement in Magnetic Telegraphs, March 20, 1849.—Claim· "moving the paper on which telegraphic marks are made, into and out of contact with a stationary pen, by which means I avoid the danger of dispersing the ink, which happens when the pen is rapidly agitated.

"I also claim operating the magnet which effects the movement of the paper.

"I also claim the arrangement for conveying ink to the stationary pen," &c., &c.—*Franklin Institute Journal, Vol.* xviii., *3d series, p.* 361.

M. Dugardin—Method of Insulating the Metallic Wires intended for Subterranean or Sub-marine Telegraph.—"This process consists of two operations. The first is the wrapping of ribbon of caoutchouc $\frac{4}{10}$ths of an inch wide, and $\frac{5}{100}$ of an inch thick, around a metallic wire, so that each turn of the wrapping shall cover about one-half of the preceding one. The second consists in wrapping spirally, and $\frac{4}{100}$ths thick, so that the edge of each turn shall touch the former, but without lapping over it. The leaden envelope serves to protect the caoutchouc from

blows, (Comptes de l'Academie des Sciences, for January 2d, 1849.)—*Franklin Institute Journal, Vol.* xvii., 3*d series, p.* 284.

Henry G. Hall, Ohio.—Improvement in Posts for Telegraphs, &c., Sept. 19, 1848.—Preventing the posts from rolling, by combining the cast iron or artificial stone shoes with the posts.—*Franklin Institute Journal, Vol.* xxiii., 3*d series, p.* 102.

To be Continued.

Translated for the Journal of the Franklin Institute.

Extract from a Report made by M. EBELMAN, *to the French Society for the Encouragement of National Industry, on a new Combustible called "Charbon de Paris," (Paris Coal,) by* M. POPELIN DUCARRE.

M. Popelin Ducarre has submitted to the Society the product which he has been manufacturing for five years, and which is now well known to the public under the name of "Charbon de Paris."

The agglutinating agent which M. Popelin Ducarre uses is the tar from gas works, which is mixed with the fine debris of the combustible which is to be utilized. The mixture is strongly compressed and moulded in cylinders. The agglumerated charcoal is exposed to a second carbonization. The tar, decomposing, leaves a residuum of hard and brilliant charcoal, which forms throughout the combustible mass a kind of network, which holds together all the parts. The product thus obtained is but slightly friable, and may be carried to great distances without notable loss.

It may easily be conceived that the process of which we have thus given a very brief description, may be applied to any carbonaceous debris, whether they come from wood, coal, turf, or other combustibles. The same combustibles (except coal) cannot be utilized in the raw state, in consequence of the contraction which they undergo during carbonization, which prevents the charcoal from having any solidity.

Manufacture of the Paris Coal.—M. Popelin Ducarre has established the following arrangements in his establishment on the *Boulevard de l'Hôpital.*

The gas tar is received in a large cistern which will contain 400,000 kilos, (882,200 lbs. av.) It is raised by pumps, and led into reservoirs near the apparatus in which the mixture is to be made. The small coals are first ground under conical mills, then mixed with the tar under cylinders; 15 kilos, (33 lbs. av.,) are employed for one hectolitre, (26 galls.) of the powder, which weighs about 30 kilos, (66 lbs.) The mixture then passes into the moulding apparatus, which compresses it powerfully, and forms it into cylinders of about 0·1 net. (3·94 in.,) log. and 0·03 lbs. (1·18 in.) diameter. These cylinders are arranged in rectangular cast-iron cases carried on cars, which are by means of a railroad, run into the furnaces where the carbonization is to take place. These furnaces are of a very ingenious construction; their arrangement is such that the combustion of the products furnished by the distillation of the tar developes the heat necessary for the carbonization. M. Popelin Ducarre proposes to place at the end of these furnaces a steam boiler which shall utilize

the lost heat, and which will give him the 15 horse power necessary for the works of his establishment.

The Paris coal thus prepared ignites with considerable ease; it burns without flame or smoke, very slowly, and covering itself with a thick coat of ashes. A piece once well lighted continues to burn in the air, which distinguishes it strongly from coke; this slowness of combustion renders the Paris coal particularly useful for domestic purposes, especially for the working classes, and for small families, for certain uses in chemical laboratories, and for many uses in the arts for which a long continued and not too high heat is wanted. Its price is 15 to 16 francs per 100 kilos, ($30 to $40 per ton.) It contains a notable proportion of ashes, from 20 to 22 per cent. according to our analyses. The calorific value is, therefore, only about three-fourths of that of charcoal. This great proportion of cinders will probably injure its utility, in cases where a very high heat is required.

For the Journal of the Franklin Institute.

Launch of the Steamship State of Georgia.

On Thursday, 12th of February, the steamship *State of Georgia* was launched from the ship yard of Vaughn & Lynn. The following are her dimensions:

Length on deck, . . .	205 feet.
Breadth of beam, ...	33 "
Depth of hold, . . .	21 "

She is to be propelled by a single side lever engine, with a cylinder of 72 inches diameter, and 8 feet stroke, constructing by Merrick & Son, of the Southwark Foundry.

This ship is the first of a new line to be placed on the route from this City to Savannah, Georgia. Should the business warrant it, a second ship will be immediately put under contract. B.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, March 18, 1852.

James H. Cresson, President, P. T., in the chair.
John F. Frazer, Treasurer.
Isaac B. Garrigues, Recording Secretary.
The minutes of the last meeting were read and approved.
A Letter was read from the Royal Institution, London.

Donations were received from the Royal Astronomical Society, London; The Akron Branch of the Cleveland & Pittsburg Company, Akron, Ohio; The Mercantile Library Association of St. Louis, Missouri; The Alton & Sangamon Railroad, Alton, Illinois; T. H. Forsyth, Esq., Senate of Pennsylvania; and Messrs. Lindsay & Blakiston, Prof. John F. Frazer, A. B. Hutton, Samuel Sloan, Dr. T. S. Kirkbride, Frederick Fraley,

Trustees Philadelphia Gas Works; and the American Philosophical Society, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of February.

The Board of Managers and Standing Committees reported their minutes.

The Board of Managers reported that they had organized, by electing Owen Evans, Esq., their Chairman, and appointing the second Wednesday evening of each month for holding their stated meeting.

The Standing Committees reported their organization, by electing their Chairman, and appointing the time for holding their stated meeting, as follows:—

On Meteorology,	Owen Evans,	Chairman,	1st Monday evening.
" The Library,	Dr. G. J. Ziegler,	do	1st Tuesday do
" Exhibitions,	Prof. J. C. Cresson,	do	1st Thursday do
" Cabinet of Models,	Chas. Welsh,	do	do do
" Minerals and Geological Specimens,	J. C. Trautwine,	do	2d Monday do
" Meetings,	Dr. B. H. Rand,	do	do do
" Science and the Arts,	Prof. J. C. Cresson,	do	2d Thursday do

On motion, the Committee on Exhibitions were instructed to take the necessary steps to hold an Exhibition of American Manufactures, next Fall, agreeably to their recommendation this evening.

New candidates for membership in the Institute (3) were proposed, and the candidates (21) proposed at the last meeting were duly elected.

Dr. Rand exhibited to the members a new form of cupping glass and artificial leech, the invention of Mr. Wm. L. Thomas, of New York. It consists of a cylinder of glass, having at its upper end a loose strong bag of caoutchouc; by means of a plunger this is extended so as to occupy the interior of the whole cylinder; upon the pressure being removed, a partial vacuum is produced, as is formed in the ordinary cupping glass by fire or the air pump. By alteration in the form or size of the tubes they may be employed on any part of the body. This apparatus is remarkable for its cheapness and simplicity.

Dr. Rand also exhibited a portion of the copper boiler of the U. S. Steamship Mississippi, showing the degree of corrosion it had undergone.

Mr. G. W. Smith exhibited a drawing of the new Cathedral of St. Peter and St. Paul, now in the process of construction in Logan Square.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on the Roofing of Dr. McDowell's Church.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "The Cause of the Failure of the Roof of Dr. McDowell's Church," in Eleventh street, above Spring Garden, Philadelphia—REPORT:

That after a full examination of the fallen roof, and careful experiments with a model of the same, they have arrived at the conclusion that the

accident was owing partly to the employment of inferior timber, and partly to defective design.

The model of two trusses of the roof (of $\frac{1}{8}$th the full size) weighed *above* $5\frac{6}{16}$ lbs., and broke with a load of 516 pounds applied at its centre. The application of the weights was very gradual, occupying about a week; and the final load of 516 lbs. was borne for some hours before fracture took place. To this load at the centre, must be added one-half the weight of the model itself, (say 3 lbs.,) making in all 519 lbs. for the total breaking load, considered as applied at the centre.

Now, in applying the result of this experiment to the case before us, we have for our guidance, the fact sustained as well by theory as by experience, that in structures of this kind, (alike in every respect except size,) the strengths vary as the squares of their respective linear dimensions; while their weights vary as the cubes of the same dimensions.

Therefore, the strength of the actual roof, as deduced from that of the model, should have required for the breaking load of two of its trusses, *at the centre*, 64 times 519 pounds, or 33,216 pounds, and twice as much, or 66,432 pounds, if equally distributed over that portion of the roof supported by the two trusses.

Let us see by what weight equally distributed, the roof actually did break:—

The weight of the two actual trusses, as deduced from the model,—$5\frac{9}{16}$ lbs. (the weight of the model,) multiplied by 512, (the cube of 8,)	2867 lbs.
Weight of purlins deduced from those of the model,	1229
Tin roof, sheeting boards for ditto, lath and plaster, ceiling joists, &c.,	11,700
About 780 square feet of area, covered with saturated snow 7 inches deep, at 18 pounds per square foot,	14,040
Total,	29,836 lbs.

Or say 30,000 lbs.

From this we see that the roof broke down with a nearly equally distributed load not exceeding 30,000 pounds to each pair of trusses, instead of 66,432 lbs., as based upon the model experiment.

The Committee do not hesitate to ascribe this discrepancy chiefly to the difference between the timber of the model, and that of the roof itself; the latter having been found to contain many large knots and imperfections of grain, abundantly sufficient to lead to the want of correspondence.

The Committee therefore believe that had all the timber of the roof been as straight-grained and free from knots as that of the model, and the construction equally good in both cases, the roof might have stood for some years longer.

Independently however of the weakness produced by imperfections in the timber, the strength of the trusses was much below that required to ensure perfect safety.

To the securing of this end, a roof should always be so proportioned as to sustain at least three times its calculated breaking load; whereas in this instance we see that the actual breaking load was not quite one-half the calculated one. With a very heavy fall of snow the load would